IGNITION SYSTEM 22

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GENERAL DESCRIPTION

The ignition system consists of a coil, distributor, ballast resistor, spark plugs and high tension leads. These components are designed to provide a powerful spark for the combustion process at the correct point in the engine cycle and to vary the timing of the spark to suit engine speed and load conditions.

The basic items in the ignition system that require periodic checks and adjustments are, ignition timing, dwell angle, and spark plug gaps. Alterations to ignition timing are achieved by rotating the complete distributor assembly.

A maladjusted ignition system will radically affect engine performance and fuel economy. The ignition system also plays a major part in the control of exhaust emission levels, an aspect which is becoming progressively important as more stringent regulations are introduced.

It is therefore, essential that the correct service repair and setting procedures are used in conjunction with the relevant specifications contained in the technical data section.

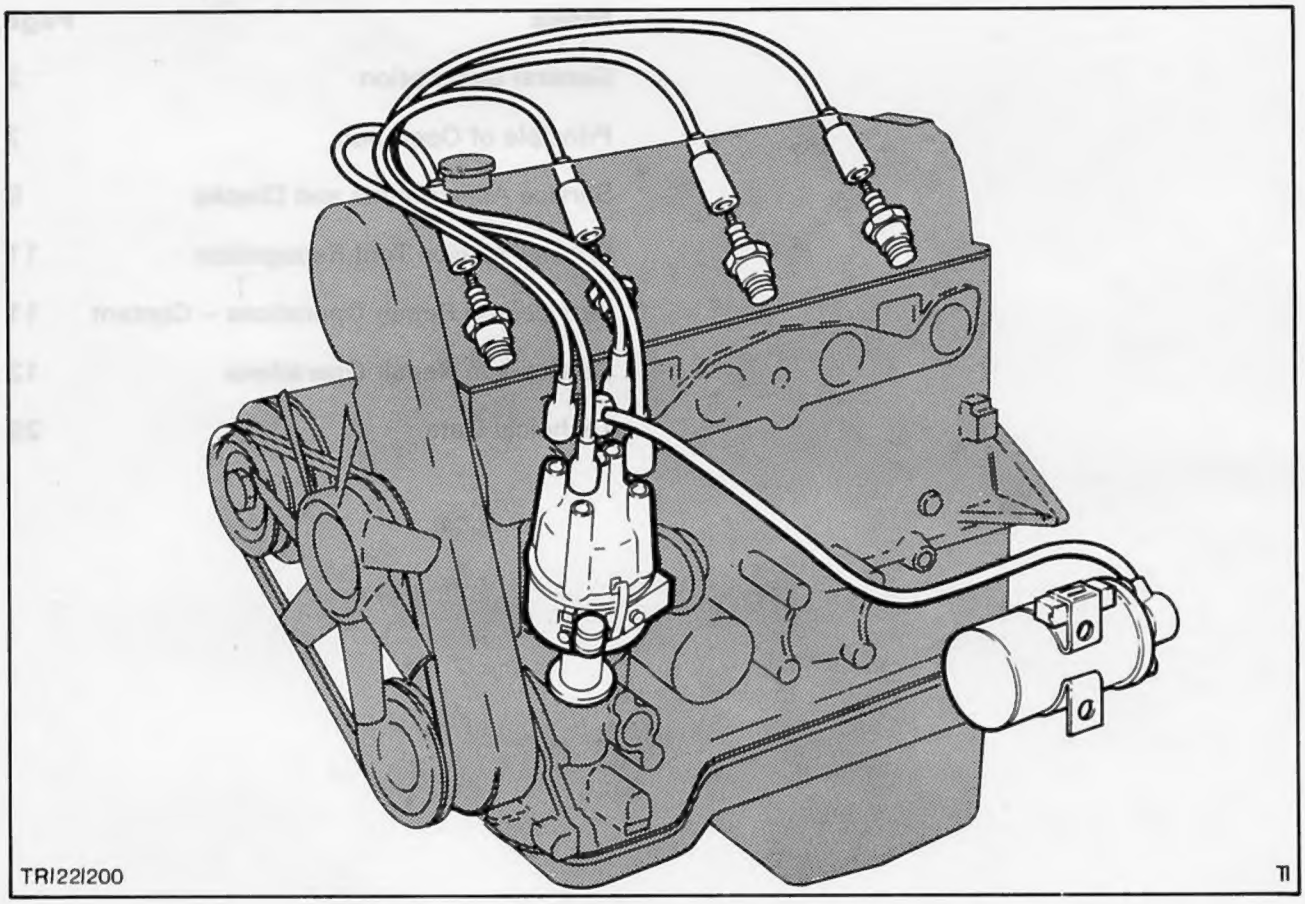


Fig. 1 Ignition System (OHC variant illustrated)

Components that make up the ignition system are described individually in the following pages

GENERAL DESCRIPTION (cont'd)

(a) Coil

The ignition coil is mounted on the battery support bracket for all model variants.

The coil consists of a cylindrical metal casing which contains two concentrically-wound copper wire coils immersed in thin mineral oil to prevent overheating. The coil is designed to run under normal conditions with a 6 volt supply to the low tension terminal. This voltage is increased to approximately 31000 volts by the coil windings working in conjunction with the distributor contact breaker points.

The coil has three terminals, Fig. 2, two low tension (LT) and one high tension (HT). The positive LT lead supplies the power source to the coil from the battery via the ignition switch. The negative LT lead connects the coil to the distributor.

The main HT lead supplies the high voltage, created within the coil, to the spark plugs via the distributor cap.

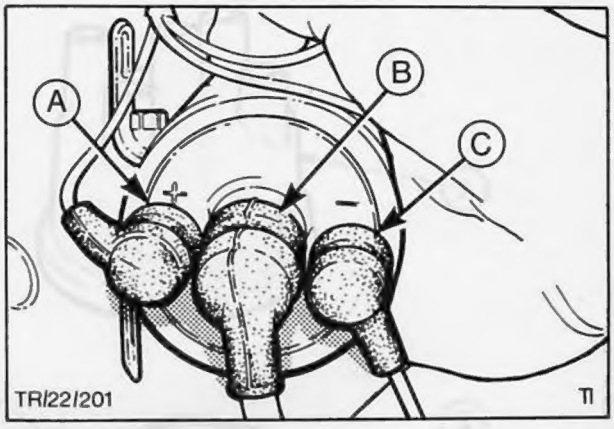


Fig. 2 Ignition coil
A – Positive (+) terminal to loom
B – Main HT terminal to distributor cap
C – Negative (–) terminal to distributor

(b) Distributor (Figs. 5 and 6 show full exploded views)

The distributor is driven at half engine speed by a skew gear from the camshaft/auxiliary shaft, and rotates in a clockwise direction on all variants except the Kent OHV engine.

The ignition advance is mechanically controlled according to engine speed by governor weights inside the distributor body and according to engine load by vacuum control.

Motorcraft distributors are used on all Transit petrol variants with minor variations to suit the various engines in the range.

The distributor fitted on the Kent OHV variant has a much smaller overall length, Fig. 4, when compared with the OHC distributor, Fig. 3.

All components that make up the distributor are available individually as Service Replacement parts, including such components as advance weights springs and drive gears.

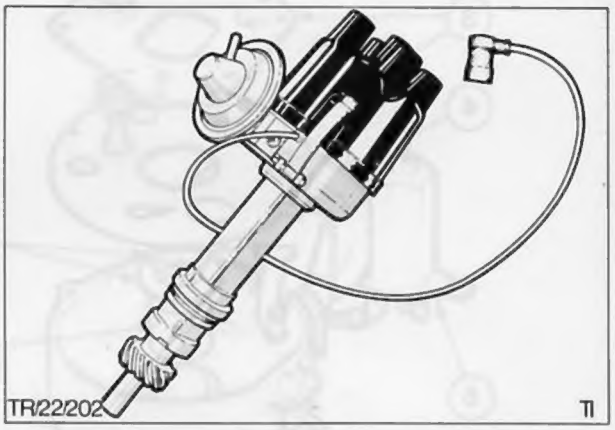


Fig. 3 Motorcraft distributor OHC type

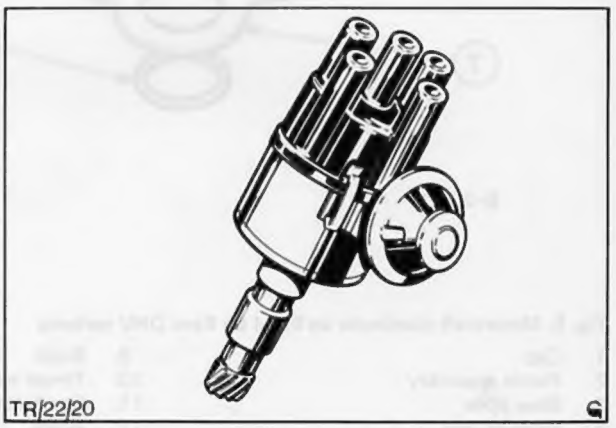


Fig. 4 Motorcraft distributor Kent OHV type

GENERAL DESCRIPTION (cont'd)

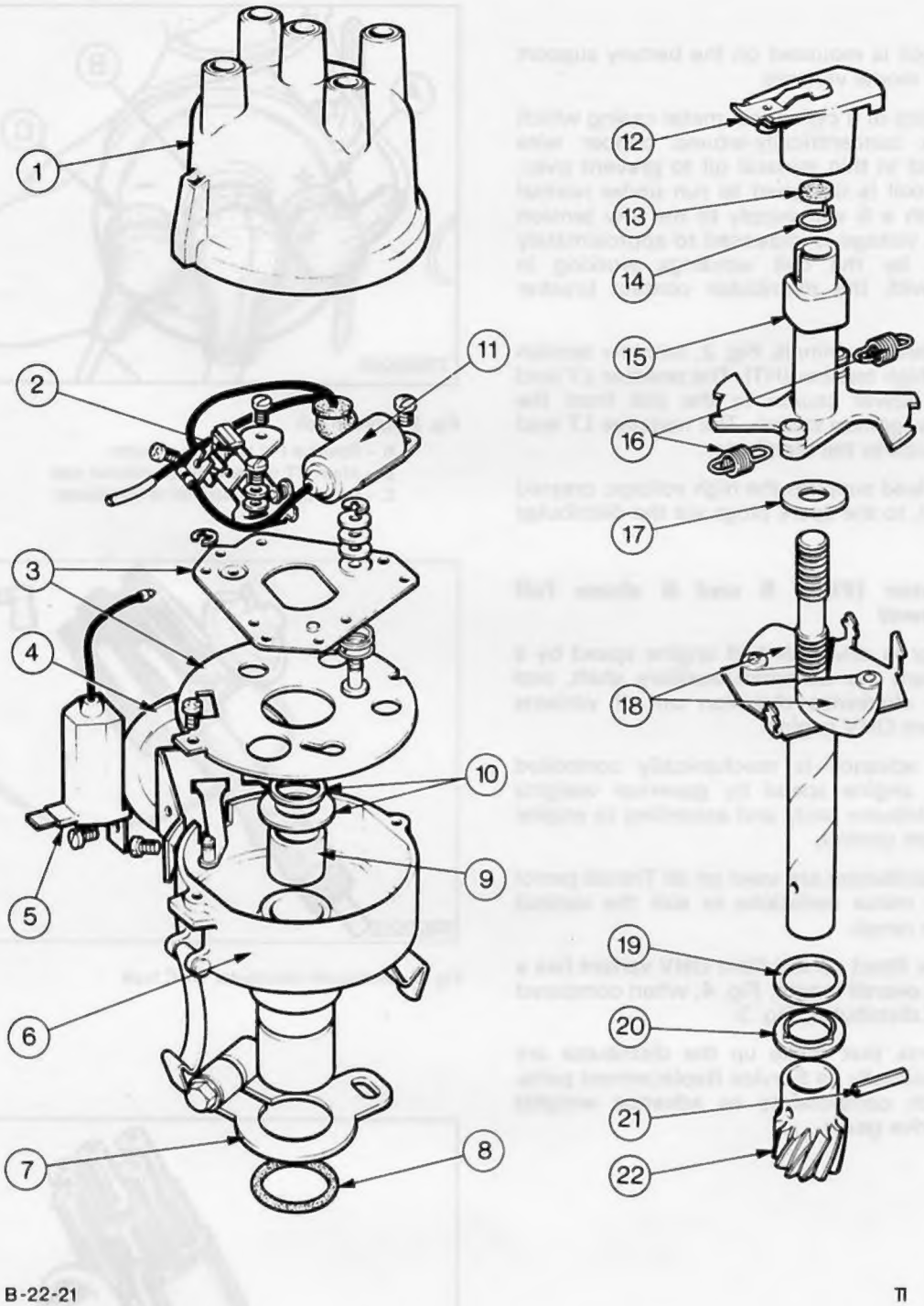


Fig. 5. Motorcraft distributor as fitted on Kent OHV variants

1. Cap
2. Points assembly
3. Base plate
4. Vacuum unit
5. Radio suppressor
6. Body
7. Distributor clamp
8. Seal
9. Bush
10. Thrust washers
11. Condenser
12. Rotor
13. Felt wick
14. Circlip
15. Cam
16. Advance springs
17. Washer
18. Advance weight assembly
19. Spacer
20. Washer
21. Pin
22. Gear

GENERAL DESCRIPTION (cont'd)

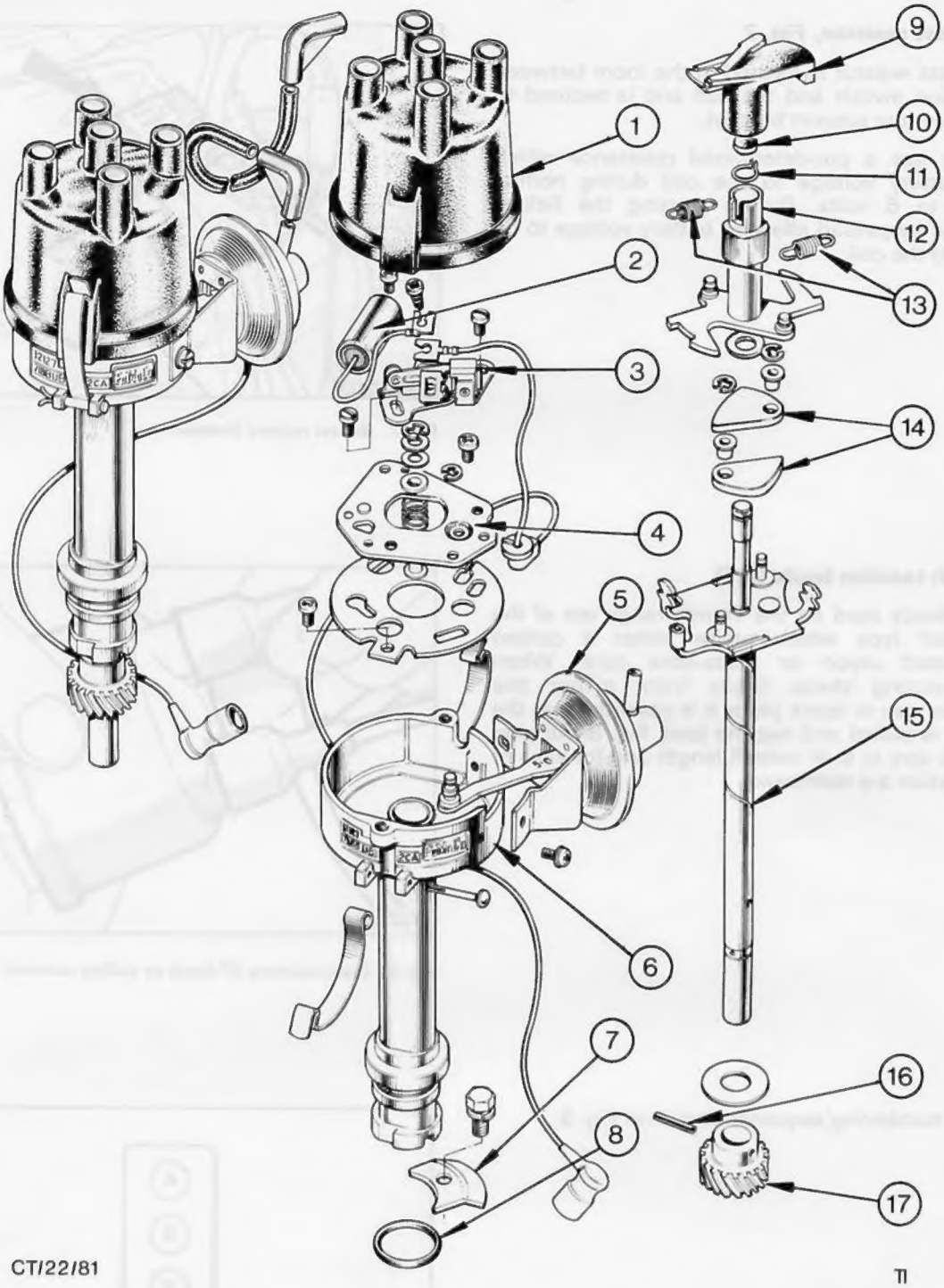


Fig. 6. Motorcraft distributor as fitted on OHC variants

1. Cap
2. Condenser
3. Contact breakers
4. Base plate
5. Vacuum unit
6. Body
7. Distributor clamp
8. Seal
9. Rotor arm
10. Felt wick
11. Circlip
12. Cam
13. Advance springs
14. Advance weights
15. Shaft
16. Pin
17. Gear

GENERAL DESCRIPTION (cont'd)

(c) Ballast resistor, Fig. 7

The ballast resistor is located in the loom between the ignition switch and the coil and is secured to the battery tray support bracket.

The unit has a pre-determined resistance which limits battery voltage to the coil during normal running to 6 volts. During starting the ballast resistor is by-passed allowing battery voltage to be applied to the coil.

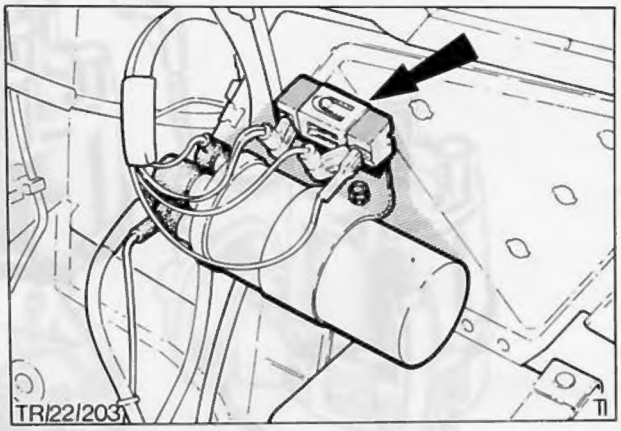


Fig. 7. Ballast resistor location

(d) High tension leads (HT)

The HT leads used on the Transit range are of the suppressor type which utilise either a carbon impregnated rayon or glass-fibre core. When disconnecting these leads from either the distributor cap or spark plugs it is essential that the terminal is pulled and not the lead, Fig. 8. All plug HT leads vary in their overall length and for ease of identification are numbered.

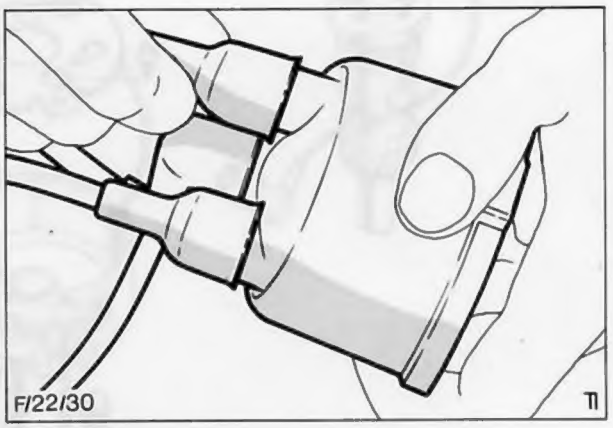


Fig. 8. Disconnecting HT leads by pulling terminal not lead

Cylinder numbering sequence shown in Fig. 9.

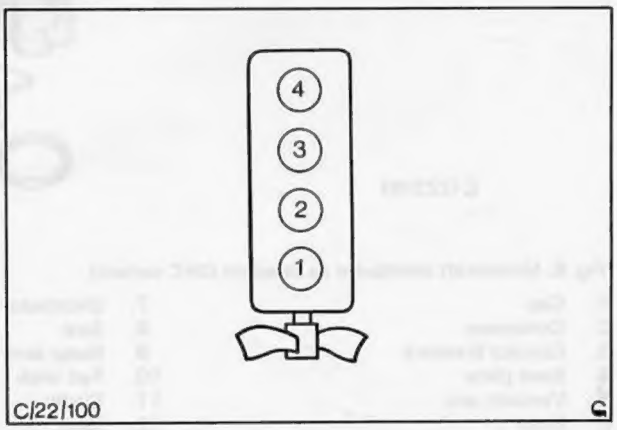


Fig. 9. Cylinder numbering sequence (All in line engine variant)

PRINCIPLE OF OPERATION

(a) Coil circuit

The ignition system is of the ballast resistor type and uses a 6 volt coil.

Under normal operating conditions the 12 volt feed to the coil is reduced by a ballast resistor to approximately 6 volts.

During starting however the ballast resistor is by-passed allowing full available battery voltage to be fed to the coil. This ensures that during cold starting, when the starter motor current draw would be high, sufficient voltage is still available at the coil to produce a powerful spark, e.g. under extreme cold conditions a starter motor can reduce the battery voltage to as low as 8 volts which with a 6 volt coil will still be adequate. If a 12-volt coil was used the HT voltage produced would not be sufficient and poor starting may be experienced.

NOTE: It is essential that the correct coil is used as a service replacement.

Fig. 10 shows in schematic form the circuit that is used when the ignition switch is in the 'off' position.

Fig. 11 shows the circuit used when the ignition switch is in the 'start' position. Note that the ballast resistor is by-passed and full available battery voltage is applied to the coil ensuring a powerful spark is achieved and thereby improving starting characteristics.

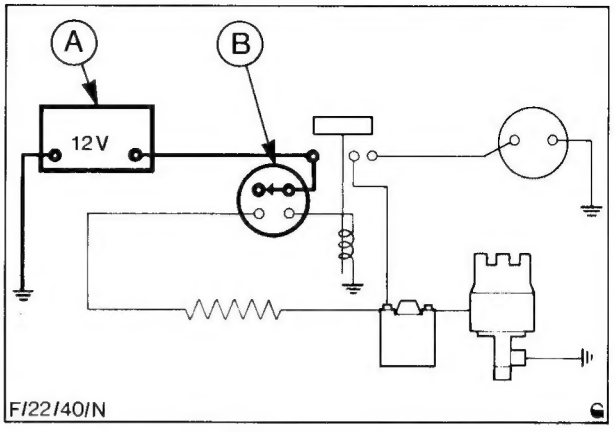


Fig. 10. Ignition switch in 'off' position
A – Battery
B – Ignition switch

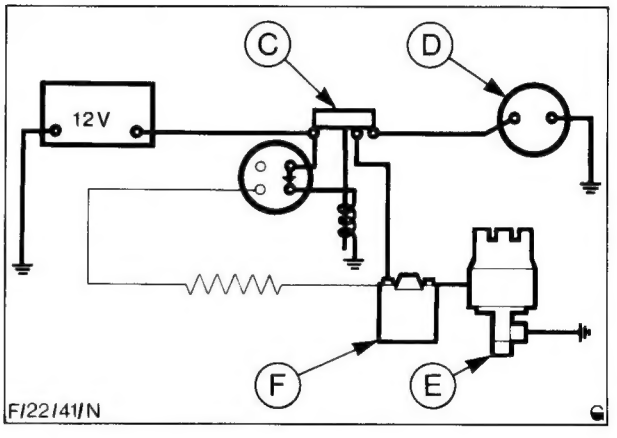


Fig. 11. Ignition switch in 'start' position
C – Starter solenoid
D – Starter motor
E – Distributor
F – Ignition coil

Fig. 12 shows the circuit used for normal operation of the ignition system. Note that the 12-volt supply is now directed through the ballast resistor before being applied to the coil.

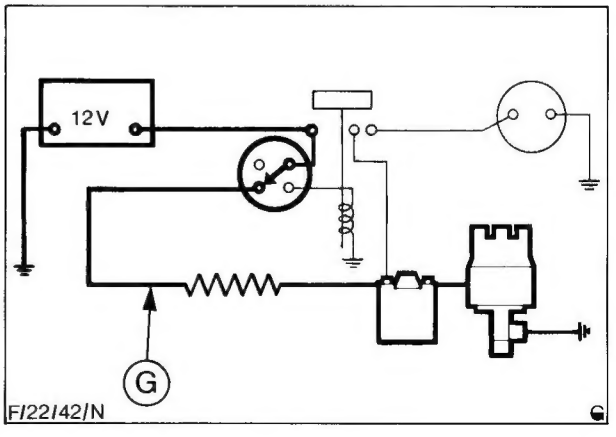


Fig. 12. Ignition switch in 'on' position
G – Ballast resistor

PRINCIPLE OF OPERATION (cont'd)

(b) Distributor

The distributor is driven at half engine speed by a skew gear on the camshaft/auxiliary shaft and rotates in a CLOCK-WISE direction when viewed from the top on OHC models and in an ANTI-CLOCK-WISE direction on Kent OHV HT voltage from the coil is fed into the distributor through the centre terminal of the cap, which is connected to a carbon rod fitted inside the cap. The voltage is then applied through the rotor arm to HT output terminals which supply the individual spark plugs.

Ignition spark advance is achieved by two separate systems (a) mechanical advance weights Fig. 13, and (b) vacuum diaphragm unit Fig. 14. Correction of spark advance is necessary because of the wide variations in engine speed and load under normal operating conditions. When accelerating or climbing hills the engine load can be high and the spark advance required is not necessarily as much as it would be on level ground at an equivalent engine speed.

(a) The mechanical governor mechanism consists of two weights pivoted so that they move outwards from the distributor shaft as the engine speed rises. As the weights move outwards they turn the cam relative to the distributor shaft and thus advance the firing point. The weights are restrained by two springs of different tension thus giving a progressive advance action, and the amount the weights move outwards is in direct proportion to the distributor shaft speed. To maintain a smooth operation throughout the engine speed range the weights follow the contours of fixed cam segments as they move outwards, and this system has the advantage of reducing the number of moving parts to a minimum.

(b) In the vacuum control mechanism, one side of the diaphragm is linked to the breaker plate and the other side is connected by a vacuum line to the carburettor, just above the throttle plate. A spring is fitted between the vacuum side of the diaphragm and the vacuum unit connection.

The vacuum applied at the diaphragm, combined with the action of the diaphragm spring, gives correct spark by moving the base plate in relation to the cam. Spark advance will vary according to the load placed on the engine. As the vacuum advance does not operate at idling speed due to the carburettor throttle plate being almost closed, a correctly retarded spark is obtained for starting.

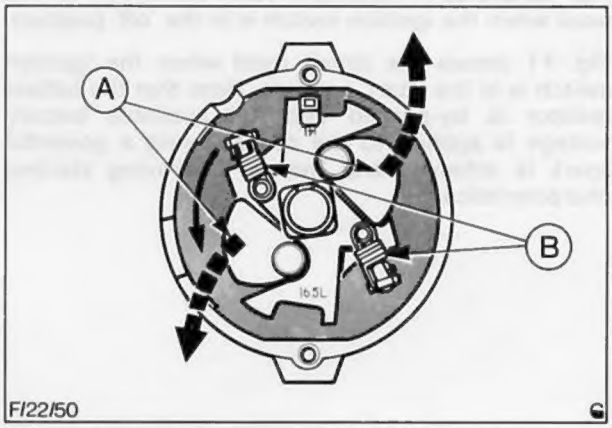


Fig. 13. Mechanical advance system
A – Advance weights
B – Advance springs

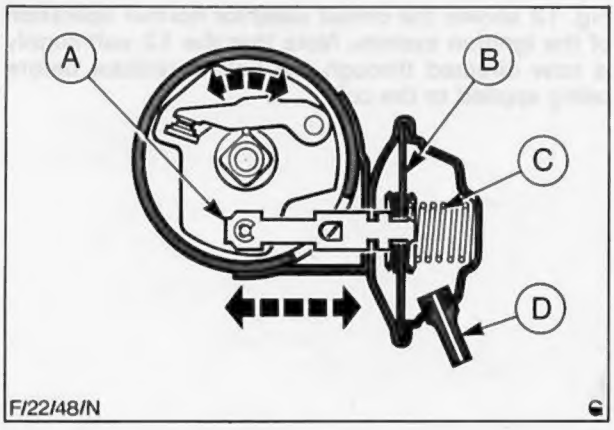


Fig. 14. Vacuum advance system
A – Vacuum advance arm
B – Diaphragm
C – Return spring
D – Vacuum supply pipe

SERVICE ADJUSTMENTS AND CHECKS

At specified service intervals, the following items on the ignition system should be checked.

1. Clean spark plugs and adjust gaps, or renew if necessary.

   The normal method of cleaning is with abrasive in a spark plug cleaner. After cleaning, the centre electrode should be filed square and gap adjusted to specified clearance.

   Ensure that all abrasive is removed from plug and clean ceramic insulator.

   Oily or wet plugs should be dried before cleaning.

   Ensure, if applicable, that sealing ring is in good condition.

   Replace plugs in cylinder head and tighten to a 3,8 Nm (38 kgf.m) (28 lbf.ft).

2. Clean high tension leads and check for security.

3. Examine distributor points, renew if necessary, clean distributor cap and coil.

   Points which have become dirty or contaminated with oil or grease should be cleaned with a stiff brush.

   Distributor contact breaker points should only be changed if they are worn, badly burnt, have excessive metal transfer or have a 'high resistance', i.e. voltage drop across points exceeds 0,25 volts.

   Contacts showing a greyish colour and only slight signs of pitting need not be renewed.

4. Lubricate:

   (a) distributor cam spindle wick with two drops of engine oil, Fig. 15.

   (b) distributor cam with high melting point grease, Spec. ESF-M1C66-A, Fig. 16.

   NOTE: Do not over lubricate any part of distributor, otherwise lubricant may reach contact breaker points, resulting in burning and difficult starting.

5. Check ignition timing, and adjust if necessary, as described overleaf.

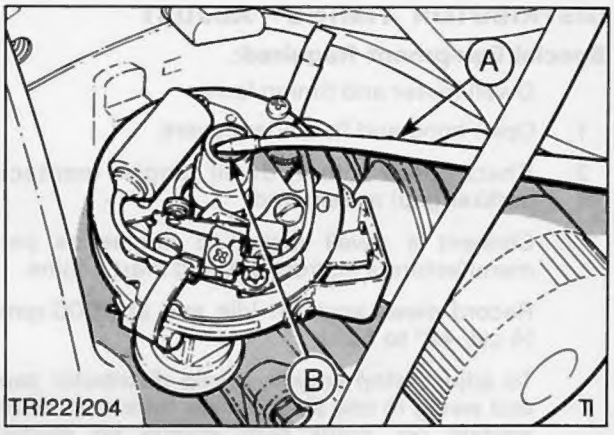


Fig. 15. Lubricating distributor cam spindle wick
A – Oil can
B – Distributor cam spindle

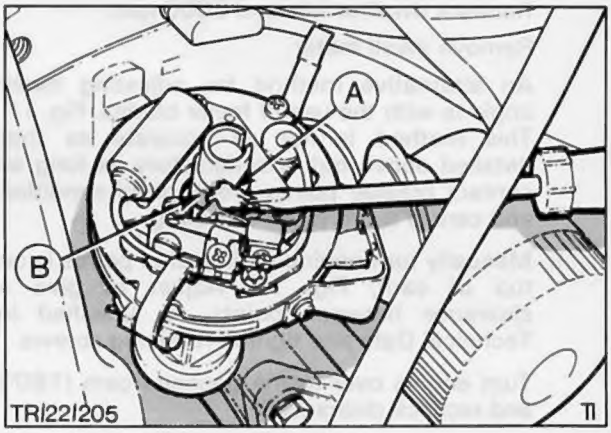


Fig. 16. Lubricating distributor cam
A – High melting point grease
B – Distributor cam

SERVICE ADJUSTMENTS AND CHECKS (cont'd)

DISTRIBUTOR TIMING – ADJUST

Special Equipment Required:

Dwell meter and timing lamp.

1. Open hood and fit fender covers.
2. Check and adjust dwell angle (contact breaker gap) as required.

   Connect a dwell meter to engine as per manufacturers instructions and start engine.

   Record dwell angle at idle and at 2000 rpm (4 cyl. 48° to 52°.)

   To adjust, stop engine, unclip distributor cap and swing to one side, detach rotor arm. With ignition on, crank over engine on starter motor and adjust contact breaker points.

   NOTE: To crank engine, either use ignition switch or connect a hand switch between a live terminal and starter solenoid power pick up connection.

   Recheck dwell at idle and 2000 rpm.

   Remove dwell meter.

   An alternative method for adjusting dwell angle is with the use of feeler blades, Fig. 17. This method is not as accurate as that detailed above but is satisfactory as long as contact breaker points are in good condition and care is taken when adjusting.

   Manually turn engine until heel of points is on top of cam, Fig. 17. Adjust to give a clearance between points, as specified in Technical Data and tighten retaining screws.

   Turn engine over to the opposite cam (180°) and recheck clearance.

3. Check and adjust ignition timing as required.

   Disconnect and plug vacuum pipe. Manually turn engine to locate timing marks on crankshaft pulley and using a piece of chalk 'high-light' TDC mark, Fig. 18. Connect timing light to engine and allow to idle at specified speed. Check ignition timing. Refer Technical Data.

   NOTE: The timing mark identification for OHC variants is illustrated in Fig. 33.

   To adjust timing, stop engine, loosen distributor clamp and rotate complete assembly. Tighten clamp and recheck timing.

4. Check ignition mechanical and vacuum advance.

   NOTE: To carry out ignition advance check, the timing light must be of the type that includes an advance meter.

   With the timing lamp still connected, restart engine and hold at 2000 rpm, adjust timing lamp and note mechanical advance, reconnect vacuum advance pipe and measure total advance. To obtain a vacuum advance figure subtract mechanical advance figure from total. Refer Technical Data.

5. Remove fender covers and close hood.

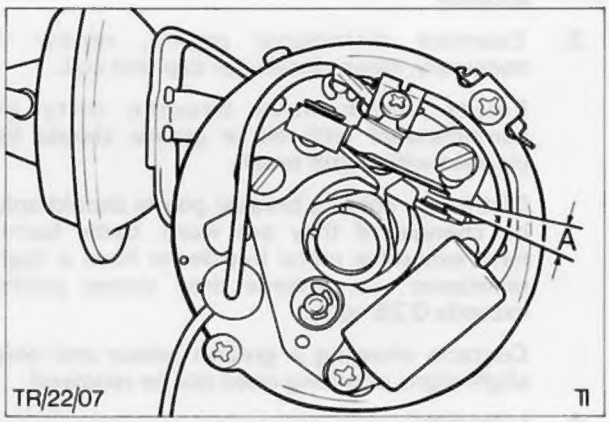


Fig. 17. Alternative method of adjusting dwell by checking contact breaker points gap
A – Points gap

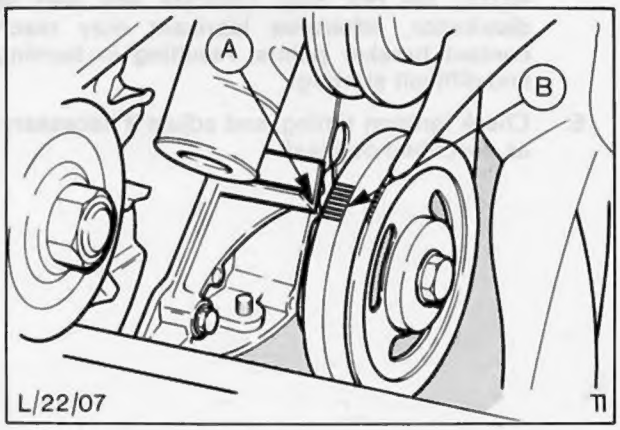


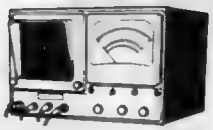
Fig. 18. Engine set on TDC
A – Timing pointer
B – TDC notch on crankshaft pulley (OHC illustrated)

SPECIAL SERVICE TOOL RECOGNITION

British Sourced	European Sourced	German Sourced	Tool Name
			No special service tools required

SERVICE AND REPAIR OPERATIONS – CONTENT

IGNITION SYSTEM	Described in this publication	Contained in operation	Also applicable to certain variants in the listed model range					
			Transit '77	Fiesta	Escort '75 onwards	Capri II	Taunus '76/Cortina '77	Granada '78 onwards
22 111 Ignition system – test	X		X	X	X	X	X	X
22 213 Distributor timing – adjust	X		X	X	X	X	X	X
22 214 Distributor – remove and install	X		X	X	X	X	X	X
22 214 8 Distributor – overhaul (distributor removed)	X		X	X	X	X	X	X
22 224 4 Vacuum unit – replace (distributor removed)	X		X	X	X	X	X	X
22 226 4 Gear – distributor – replace (Distributor removed)		22 214 8						
22 234 Contact breaker points – replace	X		X	X	X	X	X	X
22 234 4 Contact breaker points – replace (Distributor removed)		22 234						
22 244 Condenser – replace	X		X	X	X	X	X	X
22 244 4 Condenser – replace (distributor removed)		22 244						
22 284 Cap – distributor – replace	X		X	X	X	X	X	X
22 284 4 Cap – distributor – replace		22 284						
22 411 Ignition coil – test	X		X	X	X	X	X	X
22 411 1 Ignition coil – test (coil removed)		22 411						
22 414 Ignition coil – remove and install	X		X	X	X	X	X	X
22 414 4 Ignition coil – remove and install		22 414						
22 451 High tension leads resistance – check (all)	X		X	X	X	X	X	X
22 451 1 High tension leads resistance – check (all)		22 451						
22 454 Leads – high tension – replace (all)	X		X	X	X	X	X	X
22 484 Spark plugs – remove and install	X		X	X	X	X	X	X
22 484 4 Spark plugs – remove and install		22 484						
22 481 1 Spark plugs – check and adjust – (Spark plugs removed)	X		X	X	X	X	X	X



22 111 IGNITION SYSTEM – TEST

Special Equipment Required:

Electronic test equipment which includes an ohm meter, dwell meter, oscilloscope and timing light.

NOTE: If the technician is unfamiliar with use of electronic test equipment then it is essential that reference be made to existing training material before attempting the following operation.

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect two LT leads and one HT lead at coil.

   To disconnect leads pull on end of terminal not cable, Fig. 19.

   LT—Low Tension.

   HT—High Tension.
4. Disconnect HT leads at spark plugs, unclip distributor cap and detach assembly.
5. Test HT leads resistance as follows:

   Connect ohm meter to HT lead terminal and to distributor cap to rotor arm connection, record resistance, Fig. 20. If resistance is high, HT lead to cap connection should be cleaned and resistance rechecked before lead is replaced. Refer Technical Data.

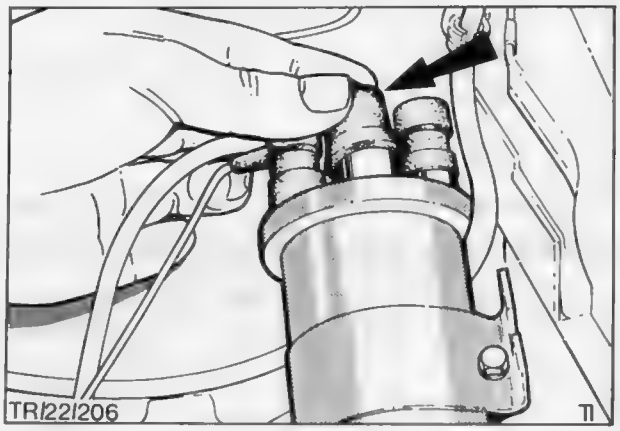


Fig. 19. HT lead removal. Hold terminal NOT lead

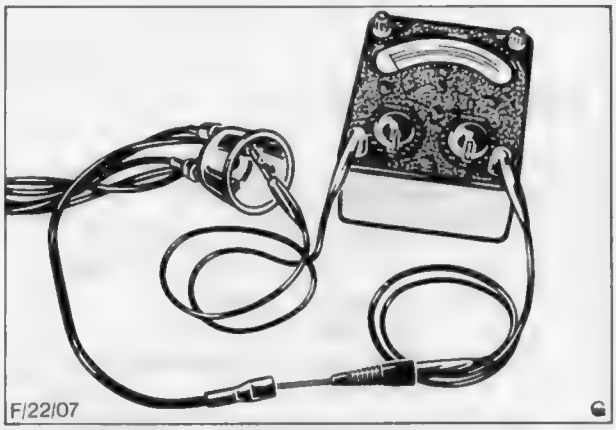


Fig. 20. HT lead resistance being checked. AVO ohm meter shown

6. Test coil resistance as follows:
   (a) Primary Circuit, Fig. 21.

   Connect ohm meter between two LT connections on coil, select appropriate scale and record resistance. Refer Technical Data.

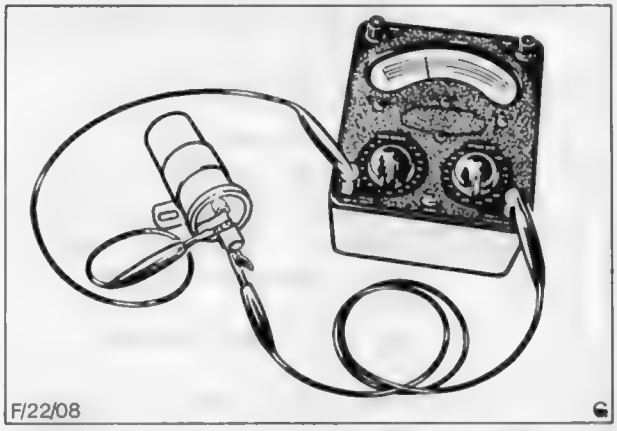
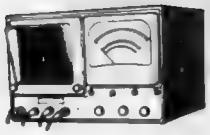


Fig. 21. Primary circuit resistance test
Note: Coil shown off vehicle for clarity



(b) Secondary Circuit, Fig. 22
Reconnect ohm meter to coil HT lead connection and either one of the two LT connections, select scale and record resistance. Refer Technical Data.

7. Remove rotor arm and inspect contact breaker points for wear or excessive burning.

8. Clean, inspect and refit rotor arm. Inspect for wear, hairline cracks and burning.

9. Inspect distributor cap for hairline cracks and connections for wear or burning, paying particular attention to the centre carbon pick up in cap. Clean cap and refit. Reconnect HT leads to spark plugs.

10. Connect test set to engine in accordance with manufacturers instructions.

11. Reconnect battery, start engine and warm up to normal operating temperature.

12. Check dwell angle, dwell variation and dwell overlap. Refer Technical Data.

(a) Dwell Angle: 48° to 52°.
This measurement is checked at idle using a dwell meter and is an average angle for all four cylinders.

(b) Dwell Variation (4° Max).
Hold engine at 2000 rpm and re-record dwell. Variation is the difference between angle recorded at idle and angle recorded at 2000 rpm.

(c) Dwell Overlap, Fig. 23 (3° Max).
Is checked using primary pattern on oscilloscope showing four cylinder super-imposed.
Overlap is difference in dwell angle between each cylinder.

NOTE: Some types of diagnostic equipment do not include an oscilloscope but still have the facility to carry out the following operations. In these cases, for detailed procedures reference should be made to the equipment manufacturers instructions.

13. Check coil polarity and maximum coil output.

(a) Coil Polarity.

With engine idling, display secondary circuit on oscilloscope and check polarity, Fig. 24. A is correct, B is incorrect.

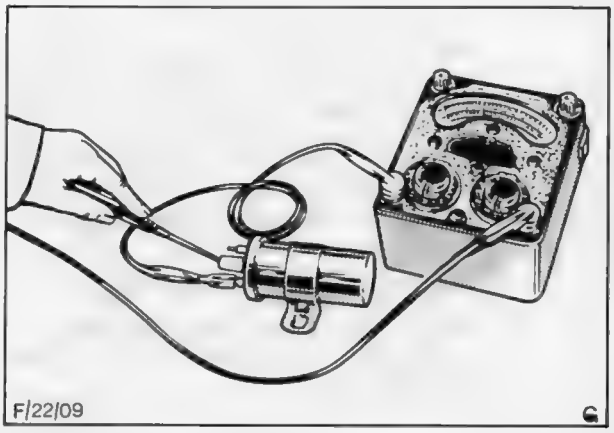


Fig. 22. Coil secondary circuit resistance test
Note: Coil shown off vehicle for clarity

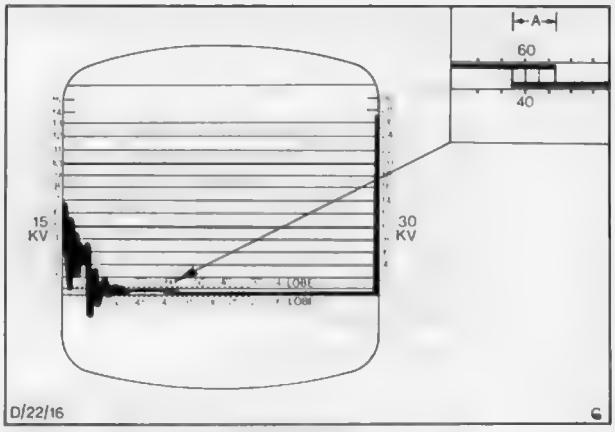


Fig. 23. Dwell overlap shown as 'A'

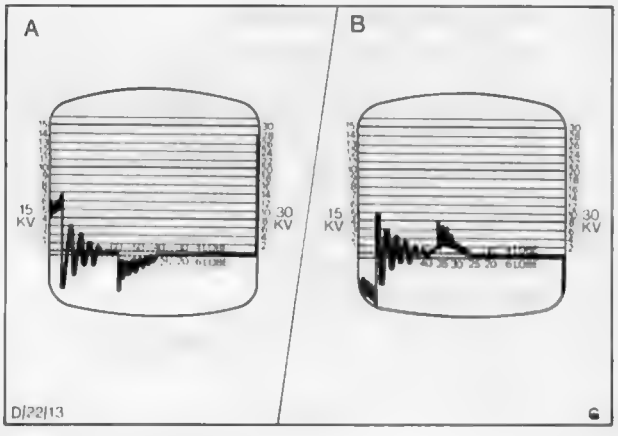
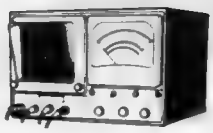


Fig. 24. Coil polarity check
A – Correct polarity B – Incorrect polarity



(b) Maximum coil output.

With engine at 1000 rpm adjust secondary oscilloscope pattern to show all four spark lines. Using insulated pliers, disconnect one HT lead at spark plug. Maximum coil voltage measured in Kilo volts will be recorded on scope as shown in Fig. 25. Refer Technical Data.

Reconnect HT lead to spark plug.

NOTE: Special care should be taken not to damage HT terminal insulation when removing with pliers.

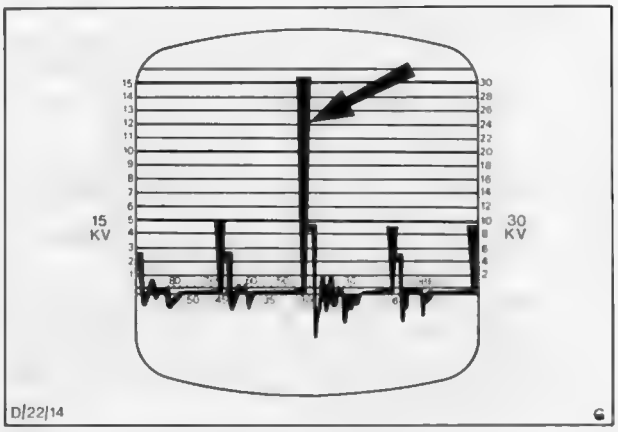


Fig. 25. Maximum coil voltage

14. Check spark plug voltage at idle and under acceleration.

(a) At idle.

Fig. 26 shows pattern that would be expected if all plugs are in good condition e.g. a voltage of between 9 KV and 10 KV and all of an equal length. If observations show a fault, reference should be made to existing training material to ascertain correct fault diagnosis.

(b) Under acceleration.

Snap open throttle to increase engine speed to approximately 3000 rpm, note plug KV readings and release throttle. On initial acceleration the plug voltage will rise to a peak, this peak should not be in excess of two-thirds of maximum coil output, sub-operation 13B

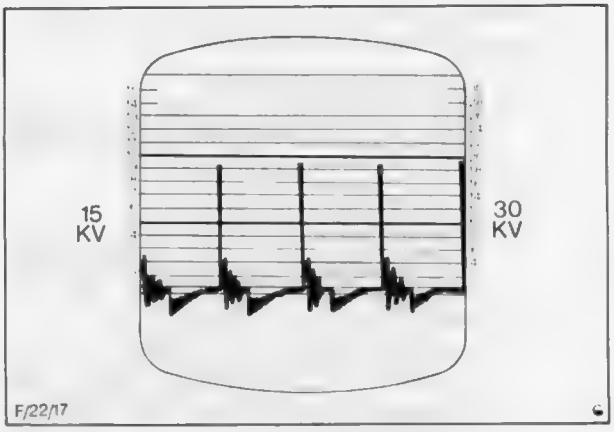


Fig. 26. Secondary scope pattern showing four cylinders

15. Check condenser condition.

Open out oscilloscope secondary pattern to show a single spark sequence. A good condenser pattern is shown as A, Fig. 27 and an example of a poor condenser pattern is shown as B. Note difference in size and number of peaks when comparing A with B.

16. Check timing and timing advance characteristic, detailed in operation 22-213.

17. Disconnect test set.

18. Remove fender covers and close hood.

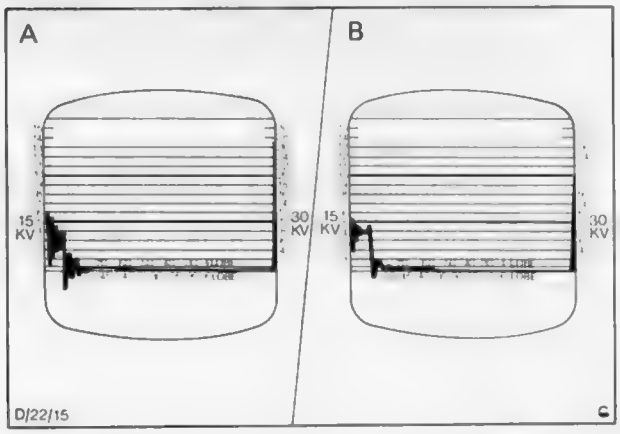
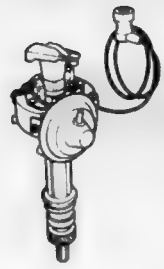


Fig. 27. Condenser pattern shown on the scope. A shows a good pattern. B shows a poor pattern



22 213 DISTRIBUTOR TIMING – ADJUST

Special Equipment Required:

Dwell meter and timing lamp.

1. Open hood and fit fender covers.
2. Check and adjust dwell angle (contract breaker gap) as follows:

   Connect a dwell meter to engine as per manufacturers instructions and start engine.

   Record dwell angle at idle and at 2000 rpm. (48° to 52°)

   To adjust, stop engine, unclip distributor cap and position to one side, detach rotor arm. With ignition on, crank over engine on starter motor and adjust contact breaker points.

   NOTE: To crank engine, either use ignition switch or connect a hand switch between a live terminal and starter solenoid power pick up connection.

   Recheck dwell at idle and 2000 rpm.

   An alternative method for adjusting dwell angle is with the use of feeler blades. This method is not as accurate as that detailed above but is satisfactory as long as contact breaker points are in good condition and care is taken when adjusting. Manually turn engine till heel of points is on top of cam, Fig. 28. Adjust to give a clearance between points, as specified in Technical Data and lock up two retaining screws. Turn engine over to the opposite cam (180°) and recheck clearance.

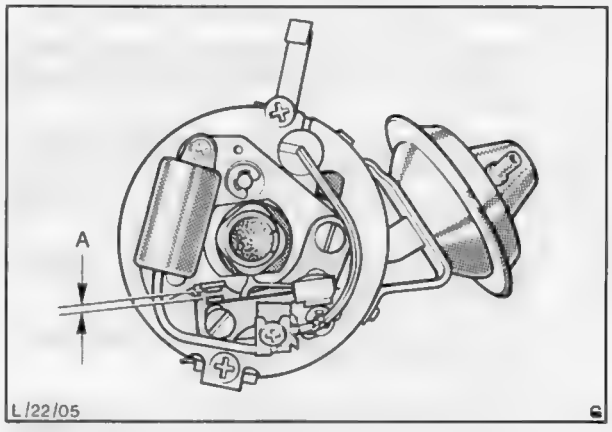


Fig. 28. Contact breaker points gap 'A'
Note: Heel of points on top of cam

3. Check and adjust ignition timing as required.

   Manually turn engine to locate timing notch on crankshaft pulley and using a piece of chalk 'highlight' notch. Connect timing light to engine as per manufacturers instructions, start engine and allow to idle at specified idle speed. Disconnect and plug vacuum pipes and check ignition timing. Refer Technical Data.

   NOTE: The timing mark identification for OHC variants is illustrated in Fig. 33.

   To adjust timing, stop engine, loosen distributor clamp and rotate complete assembly.

   Tighten clamp bolt and recheck timing, Fig. 29.

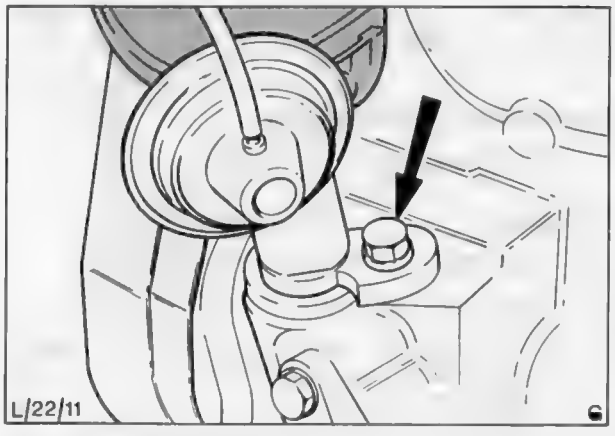
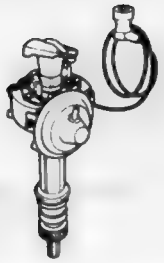


Fig. 29. Distributor clamp bolt

4. Check ignition mechanical and vacuum advance.

   NOTE: To carry out ignition advance checks, the timing light must be of the type that includes an advance meter.

   With timing lamp still connected restart engine and hold at 2000 rpm, adjust timing lamp and note mechanical advance, reconnect vacuum advance pipe and measure total advance. To obtain a vacuum advance figure subtract mechanical advance figure from total. Refer Technical Data.



When investigating ignition problems more detailed checks of the advance characteristics may be required i.e. at varying engine rpm and vacuums. This can be done in two ways:

(a) Using distributor test equipment.
There are many different types of equipment and in all cases a test procedure will be supplied by the manufacturer.

Important Note: The Technical Data section shows advance figures in crankshaft degrees, and to obtain distributor degrees, figures quoted should be divided by two.

(b) An alternative method of checking advance characteristic is by using a vacuum hand pump, Fig. 30.

i Connect hand pump directly to distributor, Fig. 31.

ii Start engine and adjust idle to 1000 rpm.

iii Adjust timing light to bring crankshaft notch back to TDC and note mechanical advance.

iv Pump vacuum to required figure (Refer Technical Data) readjust timing light and note advance.

NOTE: To calculate vacuum advance subtract mechanical advance obtained in element (iii) from the total advance obtained in element (iv).

v Repeat element (iv) at varying vacuum figures.

vi Remove vacuum pump and check mechanical advance at varying engine rpm.

NOTE: Figures quoted in the Technical Data section do not include the initial static advance.

vii Reconnect vacuum advance pipe.

5. Remove fender covers, close hood.

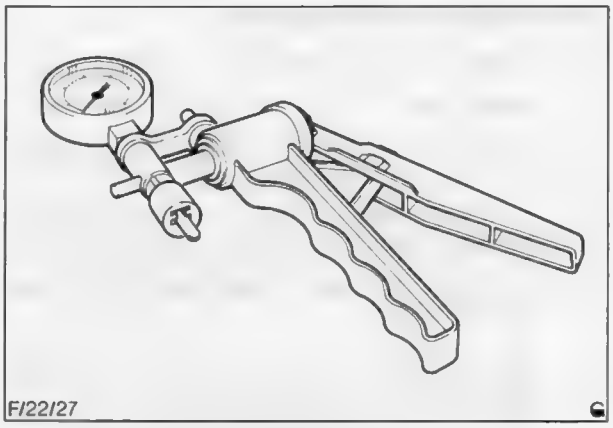


Fig. 30. Hand operating vacuum hand pump

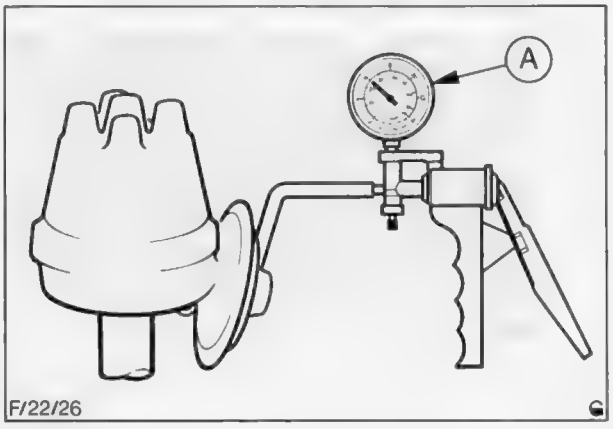


Fig. 31. Hand vacuum pump connected to distributor
A – Vacuum pump

22 214 DISTRIBUTOR – REMOVE AND INSTALL

Special Equipment Required:

Dwell meter and timing lamp.

To Remove

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect HT lead at coil, Fig. 32, unclip distributor cap and position clear of the distributor body.

NOTE: When disconnecting lead pull on terminal not lead

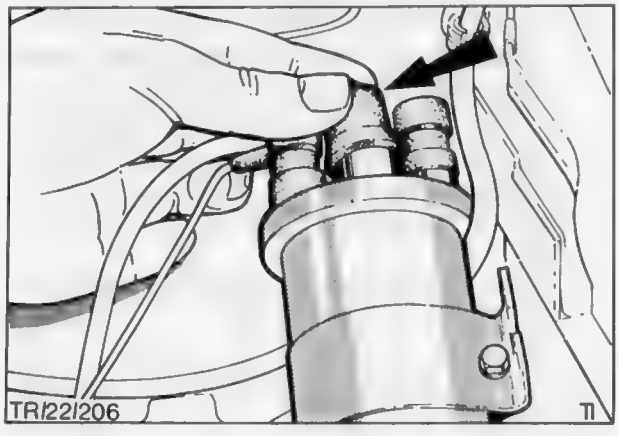


Fig. 32. HT lead removal from coil

4. Position engine on TDC No. 1 cylinder by manually turning engine to a point where rotor arm would be touching No. 1 contact in distributor cap and TDC mark on crankshaft pulley lines up with timing mark, Fig. 33.

   NOTE: The timing mark identification for the crankshaft pulley is in Fig. 33.

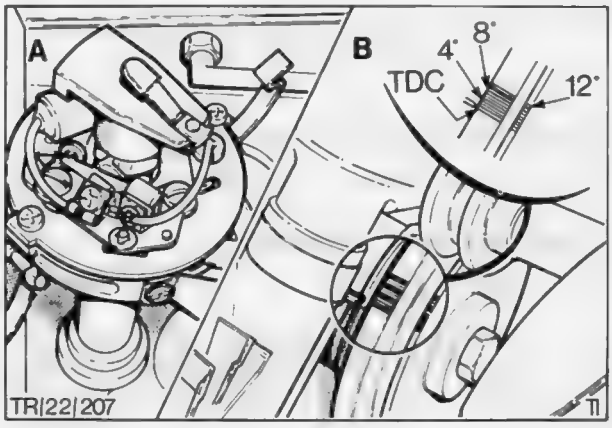


Fig. 33. Engine position on TDC No. 1
A – Rotor arm facing No. 1 contact
B – Crankshaft pulley lined up on TDC
(OHC distributor illustrated)

5. Remove single bolt located at base of distributor, slide out assembly and mark position of rotor arm relative to body, Fig. 34.

   A scribed mark will be of help when refitting distributor.

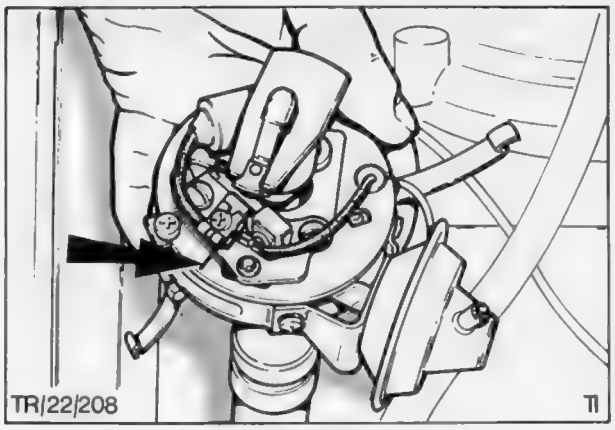


Fig. 34. Rotor arm position marked relative to body
A – Rotor arm B – Scribed line

To Install

6. Ensure engine is at TDC No. 1 position and rotor arm points to mark on body. Slide distributor assembly into position and tighten securing bolt, Fig. 35.
7. Reconnect battery.
8. Check and adjust distributor dwell angle as required.

   Detailed in operation 22 213.
9. Ensure distributor cap is clean and reconnect HT leads. Refit Cap.
10. Check and adjust ignition timing as required and tighten securing bolt, Fig. 35.

    Detailed in operation 22 213.
11. Remove fender covers and close hood.

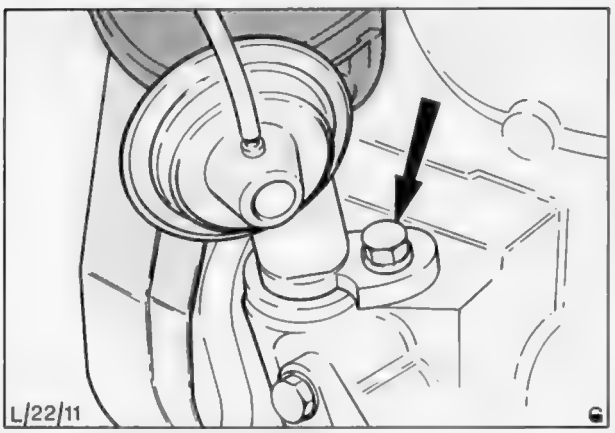


Fig. 35. Distributor securing bolt

22 214 8 DISTRIBUTOR – OVERHAUL (Distributor removed)

Motorcraft distributor only

NOTE: Full exploded view shown in Figs 5 and 6.

Special Equipment Required:

Distributor test rig.

1. Release spring clips and remove cap and rotor arm. If necessary remove HT leads from cap by gripping end of terminal, not lead, Fig. 36.

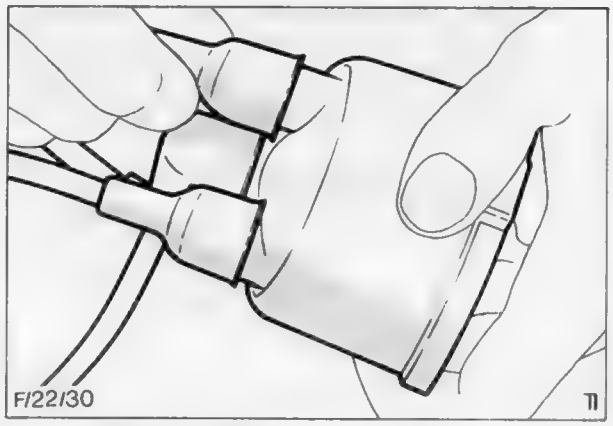


Fig. 36. Removing HT lead

2. Slacken condenser lead retaining screw and lead. Unscrew condenser retaining screw and remove condenser, Fig. 37.

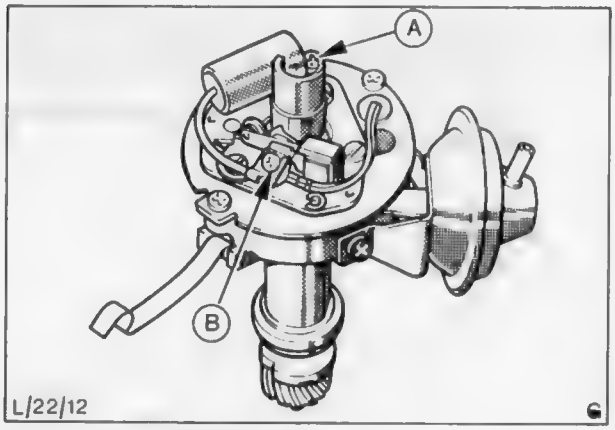


Fig. 37. Condenser removal
A – Condenser retaining screw
B – Condenser lead retaining screw

3. Remove circlip from vacuum unit pivot post and two screws retaining base assembly to body, Fig. 38.

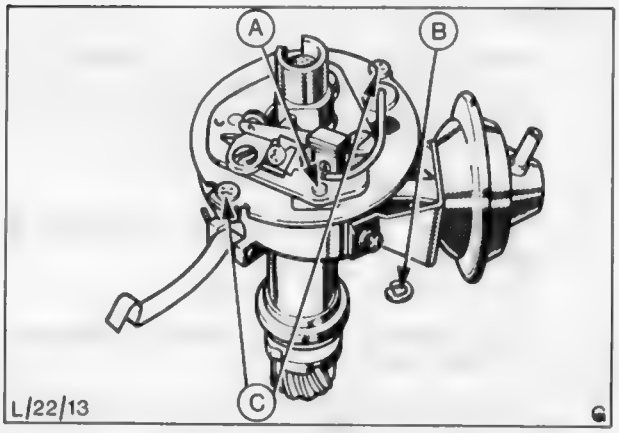
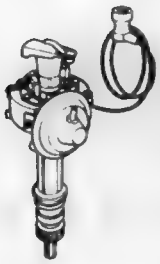


Fig. 38. A – Vacuum unit pivot post
B – Circlip
C – Base plate assembly retaining screws



4. Remove base plate assembly and overhaul as follows:

   Remove two screws securing contact breaker assembly to base plate, disconnect LT lead and detach assembly, Fig. 39.

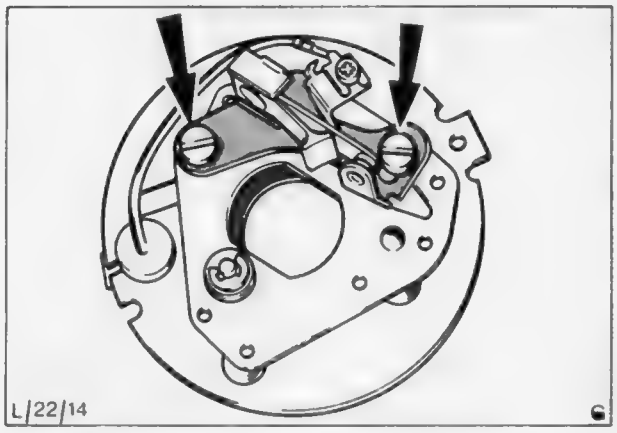


Fig. 39. Contact breaker assembly retaining screws

   Remove circlip securing upper plate pivot post and remove upper plate spring and washers, Fig. 48.

   Examine component parts for wear or damage and replace with new parts where necessary.

   Reassemble upper and lower plates and secure with circlip noting washer sequence, Fig. 40.

   Replace contact breaker assembly and loosely secure with two screws.

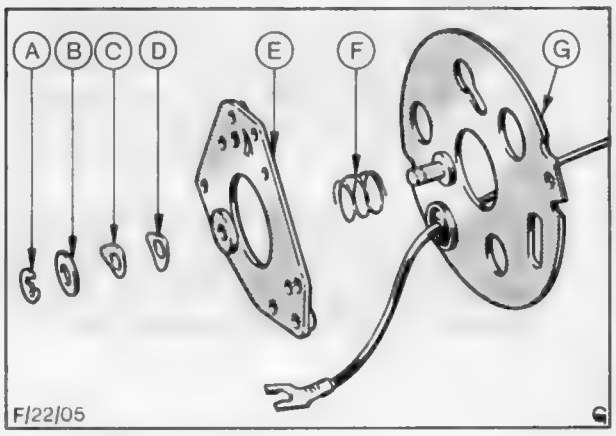


Fig. 40. Base plate assembly

A – Circlip
B – Washer
C – Wavy washer
D – Wavy washer
E – Upper plate
F – Spring
G – Base plate

5. Remove two screws retaining vacuum unit to body and detach unit, Fig. 41.

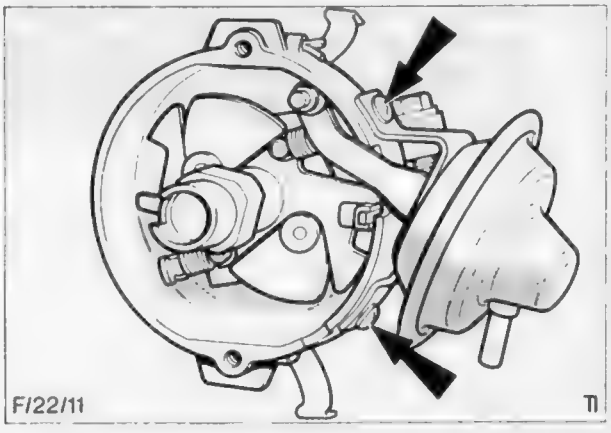
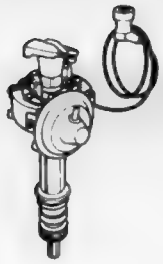


Fig. 41. Vacuum unit securing screws



6. Prise off plastic bump stop, Fig. 42.

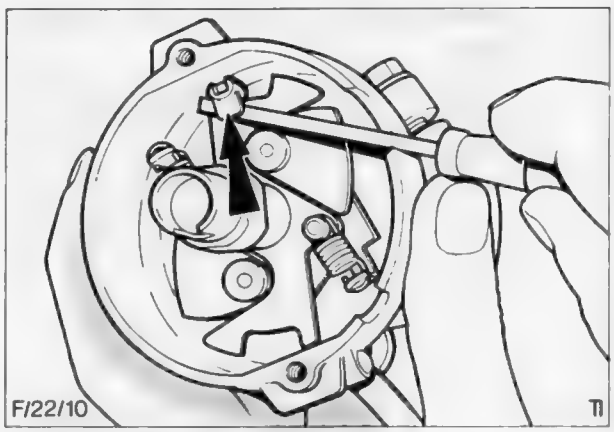


Fig. 42. Prising off plastic bump stop

7. Make a sketch (Example shown in Fig. 43) of the position of the cam and plate assembly in relation to the bump stop. (Two different numbers will be stamped on the outer edges of cam plate) also note position of the two advance springs. (Advance springs will be of different sizes).

   IMPORTANT NOTE: Figure 43 shows an example only and numbers shown on the cam plate will vary according to type of distributor being overhauled. Also advance springs could be fitted on opposite posts.

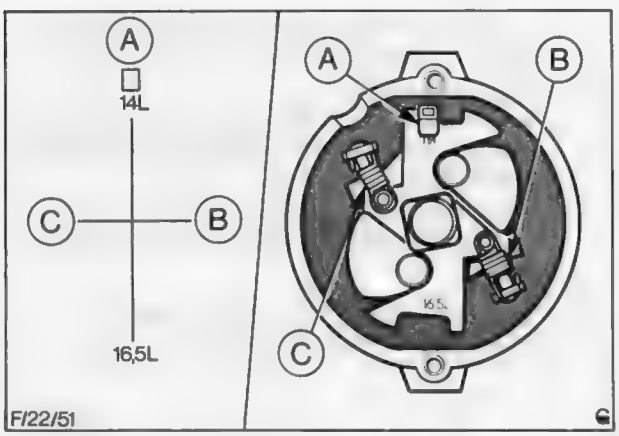


Fig. 43. Cam plate and advance spring location
A – Bump stop
B – Thin advance spring
C – Thick advance spring

8. Remove felt wick from top of cam and plate assembly, detach spring clip using either small pair of circlip pliers or two electricians screwdrivers. Detach governor weight springs and withdraw cam spindle from body, Fig. 44.

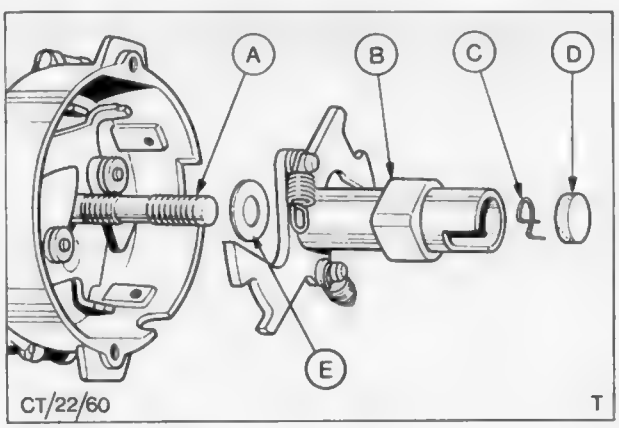
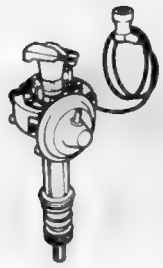


Fig. 44. A – Shaft
B – Cam and plate assembly
C – Spring clip
D – Felt wick
E – Thrust washer (OHC only)



9. Note gear position relative to shaft and scribe a mark.

   Drift out pin retaining drive gear and remove gear from shaft, Fig. 45.

   NOTE: Drive gear is a tight fit to the shaft and extreme care should be taken on removal to avoid damage to shaft.

10. Remove shaft from distributor body and examine all components for wear, replacing parts where necessary.

11. Lubricate shaft with specified oil, replace and secure drive gear with a new roll pin.

    NOTE: Check gear is not 180° out when refitting as pin bores may then be slightly misaligned.

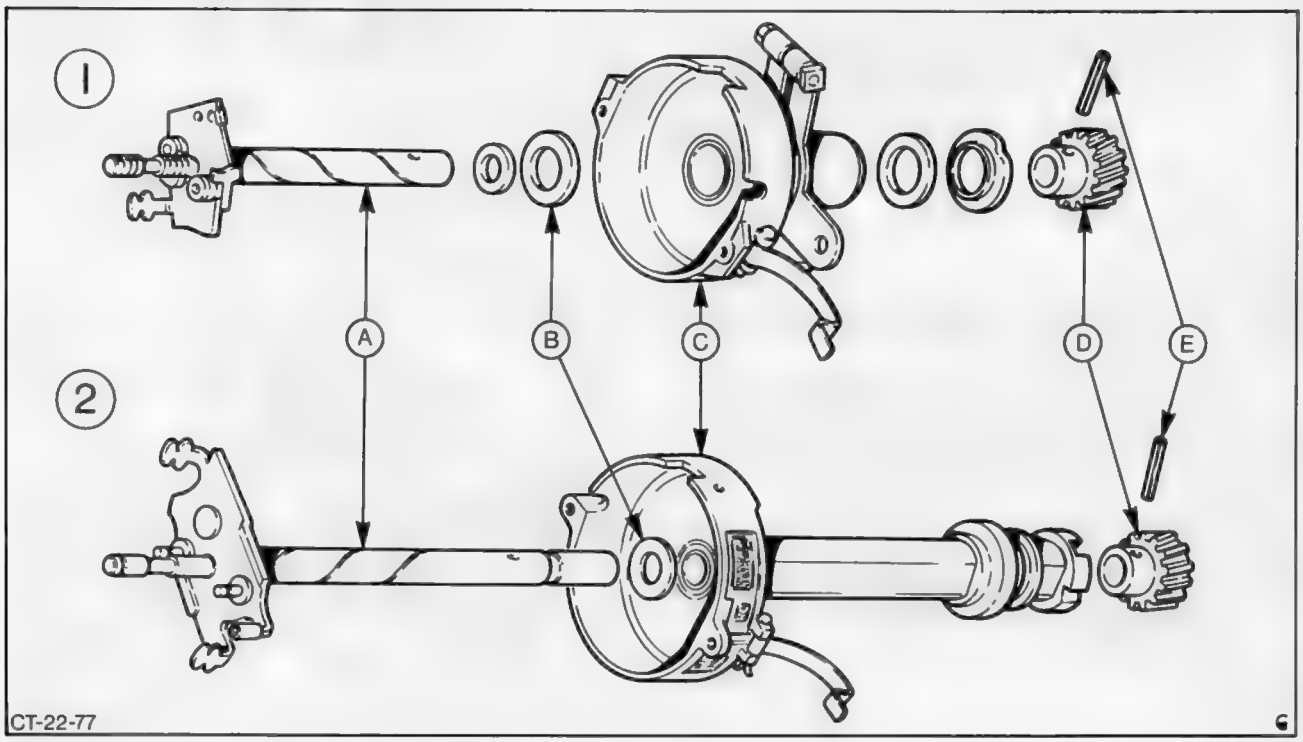
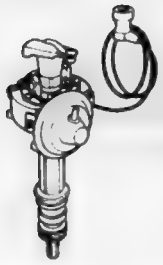


Fig. 45. 1. Kent OHV distributor 2. OHC distributor
A – Shaft
B – Thrust washer
C – Distributor body
D – Drive gear
E – Pin



22 214 8 (cont'd)

12. Position thrust washer over main shaft. (E in Fig. 44.)

13. Coat upper shaft with No. 1 grade lithium based grease (Spec. ESF-M1C74-1) ensuring undercut is completely filled. Replace cam and plate assembly and secure in position with circlip, position circlip tangs at 90° to rotor arm slot, Fig. 46.

    NOTE: Ensure cam plate is fitted correct way round in relation to the bump stop. Refer sub op 7 and Fig. 43. If cam plate is being replaced the new unit should have the same numbers stamped on the outer edges.

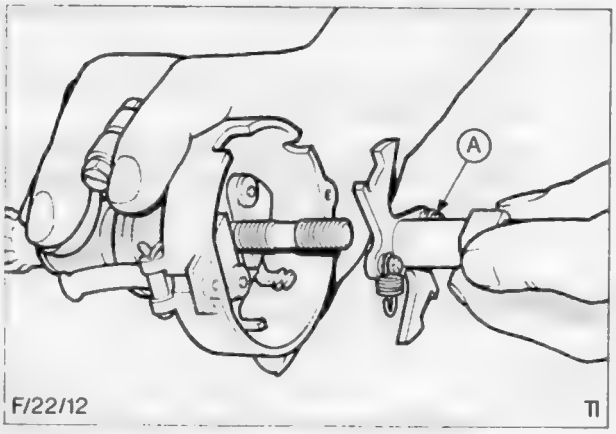


Fig. 46. Replacing cam spindle
A – Cam and plate assembly
B – Shaft undercut section

14. Refit governor weight springs to their respective posts, Fig. 43.

    NOTE: Springs must be refitted in their correct positions to ensure advance characteristic is not adversely affected.

15. Replace plastic bump stop, Fig. 47.

16. Position vacuum advance unit to body and secure with two cross head screws. Add a very small quantity of sealant (SM4G-4645-AA) (Loctite 601) to the screw threads prior to assembly.

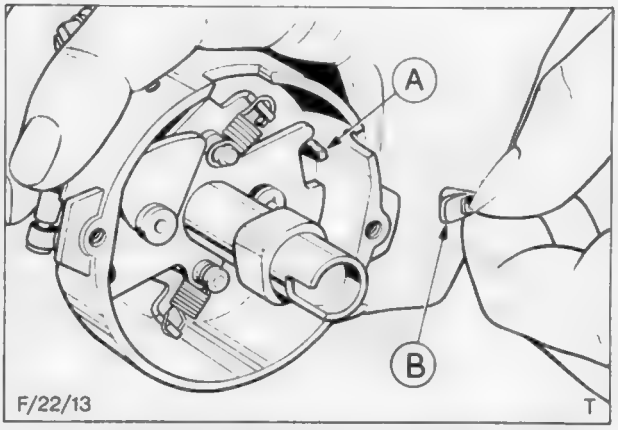


Fig. 47. Governor weight and bump stop location
A – Bump stop location
B – Plastic bump stop

17. Locate rubber grommet of LT lead in distributor body cut-out, locate base plate in position and secure with two screws.

18. Lubricate post with grease.

19. Align vacuum unit pivot post with base plate and secure with circlip, Fig. 48.

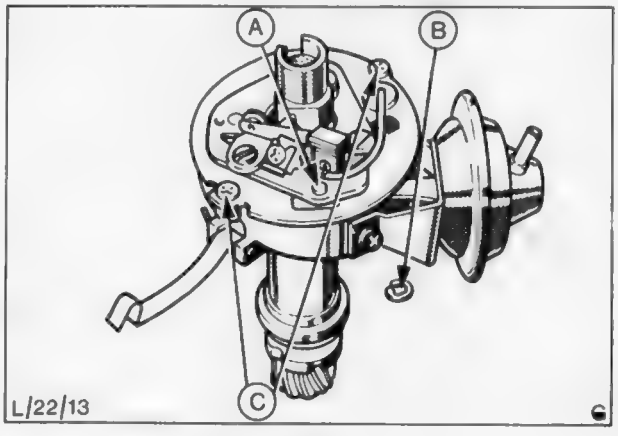
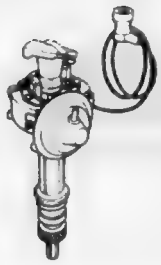


Fig. 48. A – Vacuum unit pivot post
B – Circlip
C – Base plate assembly retaining screws



20. Replace condenser on base plate and secure with screw. Front of condenser mounting should locate in cut-out in base plate.

21. Reconnect condenser and LT leads, Fig. 49.

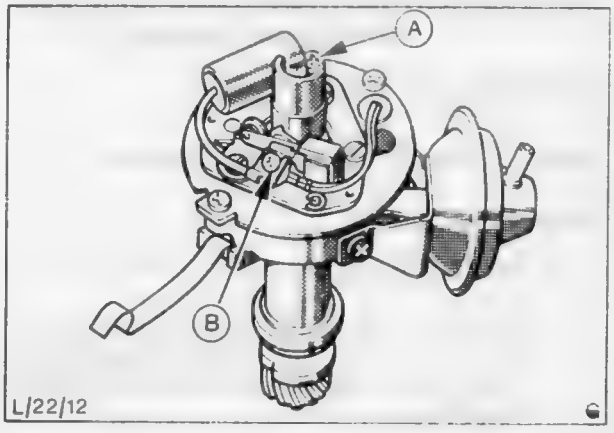


Fig. 49. A – Condenser retaining screw
B – Condenser lead retaining screw

22. Check points gap and adjust, Fig. 50.

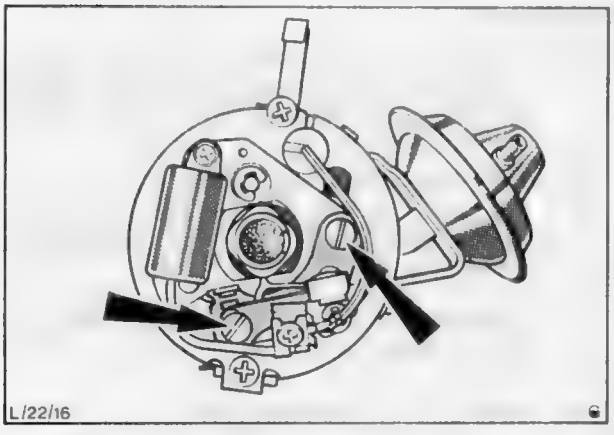


Fig. 50. Contact breaker adjusting screws

23. Check and adjust mechanical advance characteristic.

This operation should be carried out using distributor test equipment and reference must be made to the equipment manufacturers instructions for correct procedure.

Adjustment is carried out by bending the advance spring securing posts, Fig. 51. The thinner advance spring affects the advance characteristics at the lower rpm and should be correctly adjusted before adjustment is made to the thicker spring.

NOTE: The Technical Data section shows advance figures in crankshaft degrees and to obtain distributor degrees figures quoted should be divided by two.

24. Replace rotor arm, distributor cap and HT leads.

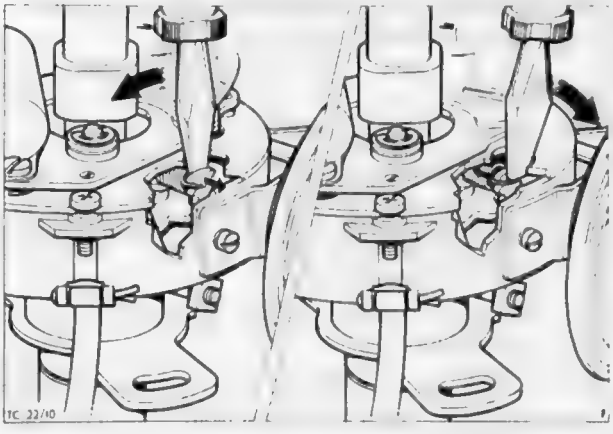
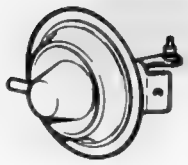


Fig. 51. Mechanical advance spring adjustment



22 224 4 VACUUM UNIT – REPLACE (Distributor removed)

MOTORCRAFT DISTRIBUTOR

Special Service Tools Required: None

To Remove

1. Release spring clips, detach cap and rotor arm.
2. Remove circlip from vacuum unit pivot post and two screws retaining base plate assembly to body, Fig. 52. Detach base plate assembly.

   NOTE: Where fitted remove radio suppressor (1 screw) from vacuum unit.
3. Remove two screws retaining vacuum unit to body and detach unit, Fig. 53.

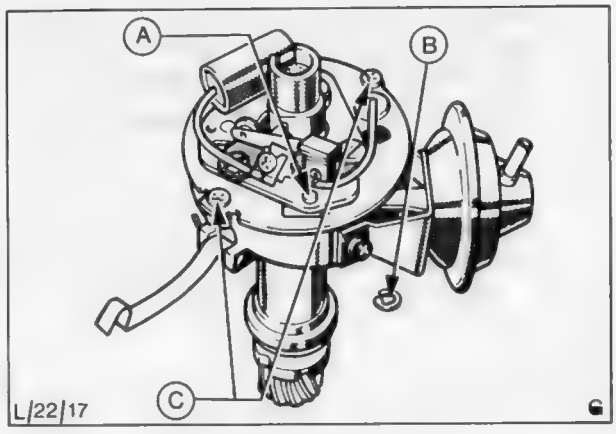


Fig. 52. Base plate removal (Motorcraft distributor)
A – Vacuum unit pivot post
B – Circlip
C – Base plate retaining screws

To Install

4. Position vacuum unit to body and secure. Add a very small quantity of sealant (SM4G-4645-AA) (Loctite 601) to screw threads prior to assembly.
5. Refit suppressor if applicable.
6. Locate rubber grommet of LT lead in distributor body cut-out. Locate base plate and secure.
7. Lubricate pivot post with high melting point grease, align post with base plate and refit circlip.
8. Refit rotor arm and distributor cap.

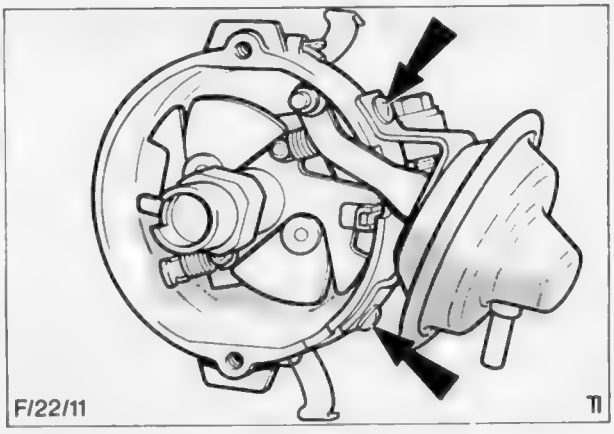


Fig. 53. Vacuum unit securing screws (Motorcraft distributor)

22 234 CONTACT BREAKER POINTS – REPLACE

Special Equipment Required:

Dwell meter, timing lamp.

To Remove

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect HT leads from plugs, unclip distributor cap and position clear of distributor assembly.
4. Remove contact breaker points, Fig. 54, as follows:

   Disconnect LT lead at points, remove securing screw(s) and detach contact breakers.

   Important Note: Care must be taken to ensure securing screw is not dropped down inside distributor. If this should occur the screw **must** be removed.

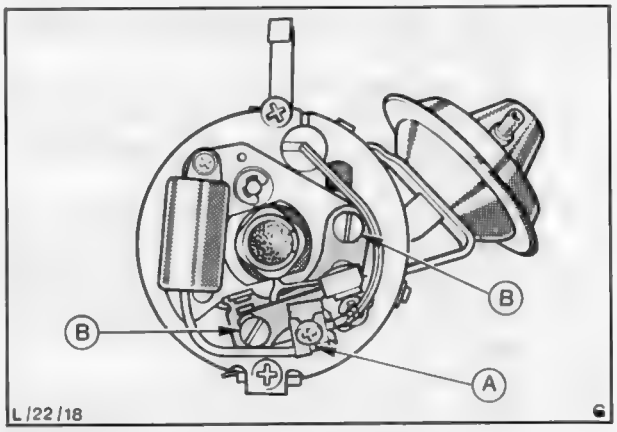
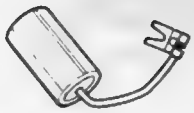


Fig. 54. Contact breaker points removal (Motorcraft distributor)
A – LT lead connection
B – Contact breaker securing screws



To Install

5. Replace points.

   Position contact breakers, refit securing screw(s) and reconnect LT lead. Grease cams using grease supplied with new points.

6. Manually turn engine until heel on contact breakers is on top of cam. Adjust to give a clearance as specified in Technical Data, and tighten retaining screw, Fig. 55.

7. Recheck clearance on opposite cam (180°).

8. Refit rotor arm and distributor cap, reconnect HT leads.

9. Reconnect battery.

10. Check and adjust ignition timing.

    Connect a dwell meter and timing light to engine. Start engine, check dwell angle.

    Using timing light, check and adjust ignition timing as required, detailed in Operation 22 213.

11. Remove fender covers and close hood.

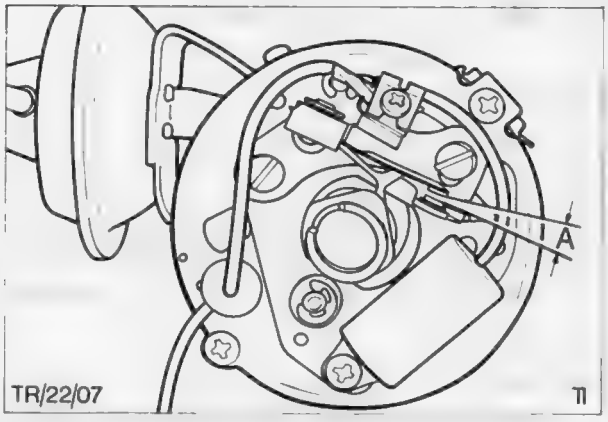


Fig. 55. Contact breaker points gap 'A'
Note: Heel of points on top of cam
(Motorcraft distributor illustrated)

22 244 CONDENSER – REPLACE

Special Service Tools Required: None

To Remove

1. Open hood and fit fender covers.

2. Disconnect battery.

3. Disconnect HT lead at coil, Fig. 56, unclip cap and position clear of the distributor body.

   NOTE: When disconnecting HT leads pull terminal not lead.

4. Loosen condenser lead retaining screw and disconnect lead. Remove retaining screw and detach condenser, Fig. 57.

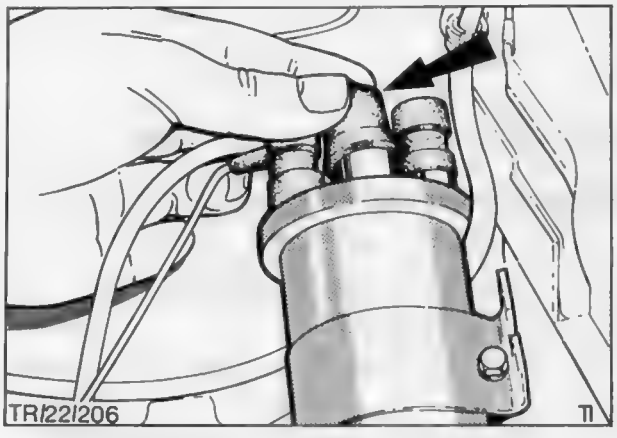


Fig. 56. HT lead removal from coil

To Install

5. Position condenser, secure and reconnect lead(s).

6. Refit distributor cap and reconnect HT lead at coil ensure cap is clean before installation.

7. Reconnect battery.

8. Remove fender covers and close hood.

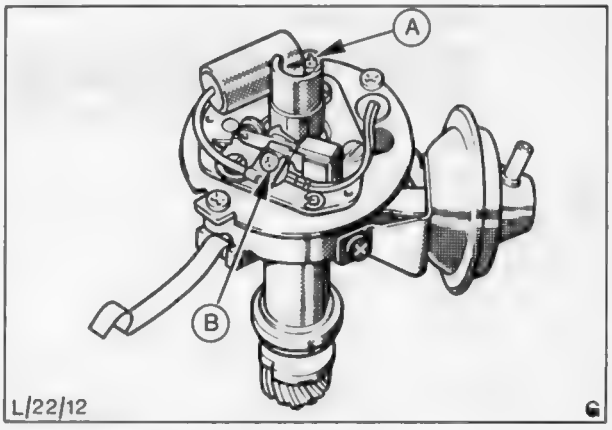


Fig. 57. Motorcraft condenser removal
A – Condenser securing screw
B – Condenser lead retaining screw

22 284 CAP – DISTRIBUTOR – REPLACE

To Remove

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect HT leads from spark plugs and coil, unclip cap from distributor and detach.

   When disconnecting leads pull on terminal, not lead.

To Install

4. Reconnect HT leads in correct order, Fig. 58. and clip cap in position.
5. Reconnect battery.
6. Start engine and check operation.
7. Remove fender covers and close hood.

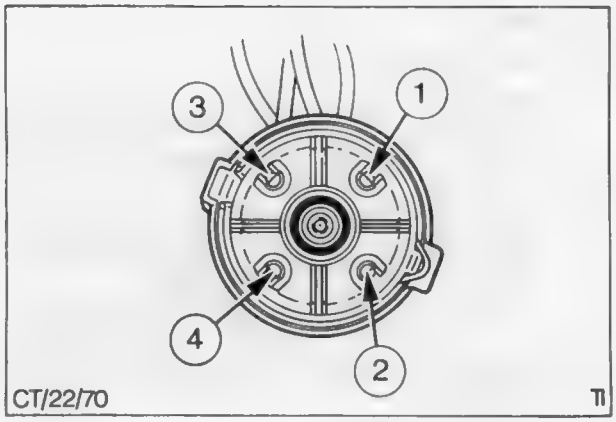


Fig. 58. Motorcraft distributor cap showing HT lead connections

22 411 IGNITION COIL – TEST

Special Equipment Required:

Ohm meter, oscilloscope.

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect two LT leads and one HT lead at coil.
4. Test coil resistance. Refer Technical Data.

   (a) Primary circuit

   Connect ohm meter between two LT connections on coil. Select appropriate scale and record resistance, Fig. 59.

   (b) Secondary circuit.

   Reconnect ohm meter between HT lead connection and either LT connection, select scale and record resistance, Fig. 60.
5. Reconnect loom to coil.
6. Reconnect battery.

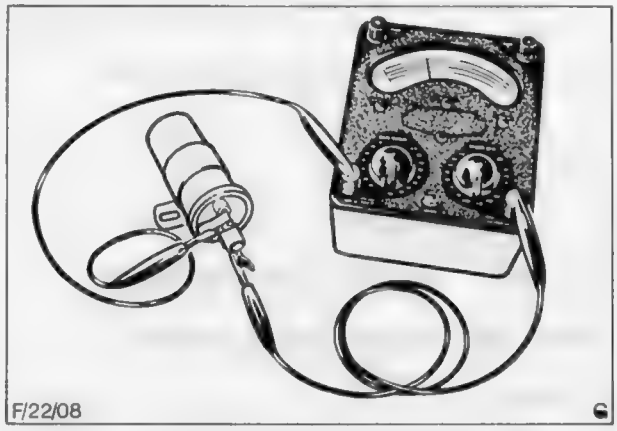


Fig. 59. Coil primary circuit resistance check (Coil removed for clarity)

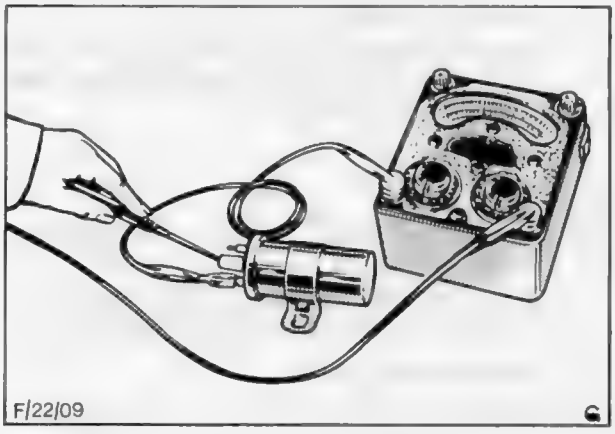


Fig. 60. Coil secondary circuit resistance check (Coil removed for clarity)

7. Test coil polarity and maximum output:

   (a) Coil polarity.

   Connect a test set oscilloscope to engine as per manufacturers instructions. Select primary circuit and display on oscilloscope start engine and check coil polarity, Fig. 61.

   A is correct, B is incorrect.

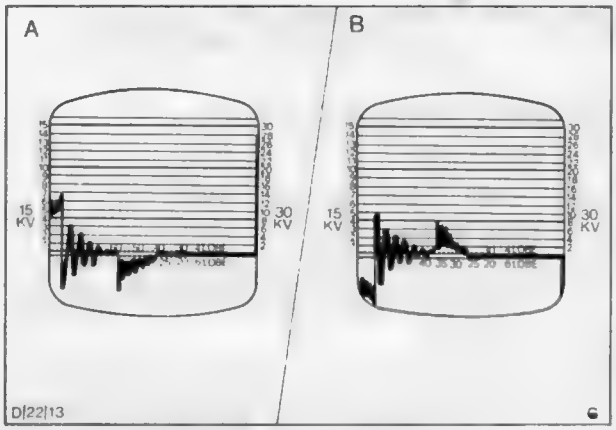


Fig. 61. Coil polarity check
A – Correct B – Incorrect

   (b) Maximum coil output.

   With engine at 1000 rpm, select secondary oscilloscope pattern and using insulated pliers disconnect one of the HT leads at a spark plug. Maximum voltage measured in kilo volts, will be recorded on scope as shown in Fig. 62. Refer Technical Data.

   NOTE: Special care should be taken not to damage HT terminal insulation when removing with pliers.

8. Reconnect HT lead and disconnect test set.
9. Remove fender covers and close hood.

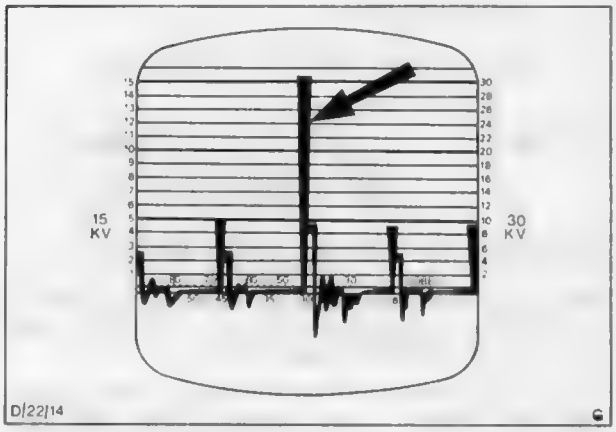


Fig. 62. Maximum coil voltage read on the RH scale

22 414 IGNITION COIL – REMOVE AND INSTALL

Special Service Tools Required: None

To Remove

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect HT and LT connections at coil.
4. Remove two screws and detach coil and strap assembly.

To Install

5. Position coil and strap assembly secure with two screws. Reconnect HT and LT connections. Positive terminal to loom. Negative terminal to distributor, Fig. 63.
6. Reconnect battery.
7. Start engine and check operation.
8. Remove fender covers and close hood.

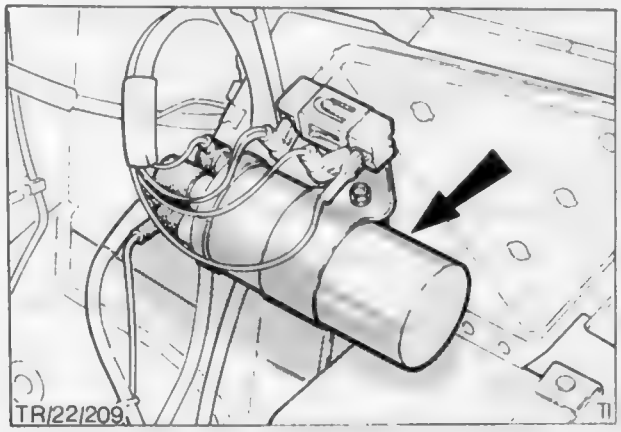
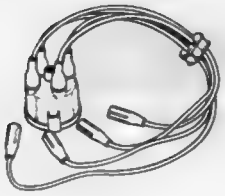


Fig. 63. Coil installation



22 451 HIGH TENSION LEADS – RESISTANCE CHECK (ALL)

Special Equipment Required:

Ohm meter.

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect HT leads at spark plugs and coil. Unclip distributor cap, detach cap and leads assembly.
4. Connect ohm meter to HT terminal lead and to distributor cap to rotor arm connection, record resistance, Fig. 64. Refer Technical Data. If resistance is high, lead to cap connection should be cleaned and resistance rechecked before lead is replaced.
5. Clean distributor cap and refit assembly, reconnect HT leads.
6. Reconnect battery.
7. Remove fender covers and close hood.

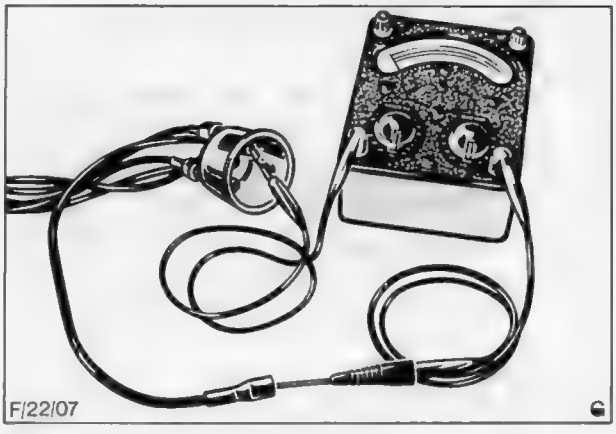


Fig. 64. Resistance check

22 481 1 SPARK PLUGS – CHECK AND ADJUST (Spark plugs removed)

Special Service Tools Required: None

When required by service intervals or by suspected malfunction, plugs should be removed and examined for wear, damage, fouling, etc.

The normal method of cleaning is with abrasive in a spark plug cleaner. After cleaning, centre electrode should be filed square and gap adjusted to specified clearance.

Ensure that all abrasive is removed from plug, clean ceramic insulator if necessary to remove all traces of dirt.

Oily or wet plugs should be dried before cleaning.

22 484 SPARK PLUGS – REMOVE AND INSTALL

To Remove

1. Open hood and fit fender covers.
2. Disconnect battery.
3. Disconnect HT leads at spark plugs and unscrew plugs from cylinder head.

To Install

4. If applicable, ensure sealing rings are in good condition, replace plugs and tighten to 3,8 Nm (3,8 kg.m) (28 lb.ft)
5. Reconnect battery.
6. Remove fender covers and close hood.

TECHNICAL DATA

Coil

Manufacturer	Bosch, Femsa, Lucas or Polmot
Type	Low voltage for use with 1,5 ohm ballast resistor
Output	31,0 kilovolt (minimum) – Open circuit condition on test rig
	23,0 kilovolt (minimum) – Open circuit condition in vehicle
Primary resistance	0,95 to 1·35 ohms
Secondary resistance	5000 to 9000 ohms

Spark Plugs

Type OHV (Kent) 1600	Motorcraft AGR 22
OHC 1600	Motorcraft BF22
OHC 2000	Motorcraft BF32
Electrode Gap	
All	0,60 mm (0,025 in)
Firing Order OHC	1, 3, 4, 2
OHV (Kent)	1, 2, 4, 3

Distributor

Manufacturer	Motorcraft
Type	Single pair contact breaker point
Automatic advance	Mechanical and vacuum control
Drive OHV (Kent)	Screw gear from camshaft
OHC	Screw gear from auxiliary shaft
Rotation (view from top)	
OHV (Kent)	Anti-clockwise
OHC	Clockwise
STATIC ADVANCE (Initial)	
All Models (except Nigeria)	6° B.T.D.C.
Nigeria only (Heavy duty)	2° B.T.D.C.
Condenser capacity	0,21 to 0,25 m.fd
Contact breaker points gap	0,64 mm (0,025 in)
Dwell angle	48° to 52°
Dwell variation	4° maximum
Dwell overlap	3° maximum
Distributor shaft end float	0,64 to 0,84 mm (0,025 to 0,033 in) (end float figure is a preload rating on OHV)
Lubrication (distributor shaft)	Turbine hydraulic oil ESF-M2C70-A
	e.g. Shell Turbo 41-Mobil DTE extra heavy – Texaco Rando-F-Castrol Perfecto heavy

HT Leads

Resistance	30,000 ohms maximum per lead

TECHNICAL DATA (cont'd)

Advance Characteristics

Advance at 2000 rpm (Engine rpm)	Mechanical	Vacuum	Total
January to April '78			
1.6 Kent (OHV)	7° to 11°	22° to 30°	29° to 41°
1.6 OHC (LC)	16° to 20°	6° to 10°	22° to 30°
2.0 OHC (Manual)	7.5° to 11.5°	13° to 19°	20.5° to 30.5°
2.0 OHC (Automatic)	7.5° to 11.5°	9° to 15°	16.5° to 26.5°
2.0 OHC (Economy)	7° to 11°	13° to 19°	20° to 30°
2.0 OHC (Nigeria)	5° to 9°	20° to 28°	29° to 37°
April '78 onwards			
1.6 Kent (OHV)	7° to 11°	22° to 30°	29° to 41°
1.6 OHC (LC)	13° to 17°	9° to 13°	22° to 30°
2.0 OHC (Manual)	5° to 9°	16° to 22°	21° to 31°
2.0 OHC (Automatic)	5° to 9°	11° to 17°	16° to 26°
2.0 OHC (Economy)	7° to 11°	13° to 19°	20° to 30°
2.0 OHC (Nigeria)	5° to 9°	20° to 28°	25° to 37°

Detailed Advance Characteristics

1600 Kent OHV Colour Code Red/Orange 761F 12100 AA

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
400 and below	0
500	−1° to +1°
1000	−1° to +1.5°
1500	2.5° to 6.5°
2000	7° to 11°
2500	11.5° to 15.5°
3000	16° to 20°
3500	21° to 25°
4000	25° to 29°
4350 and above	28.5° to 32.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
76 (3.0) and below	0
104 (4.0)	−1° to +1.5°
127 (5.0)	−1° to +5°
152 (6.0)	3.5° to 9.5°
203 (8.0)	11.5° to 17.5°
254 (10.0)	18° to 25°
304 (12.0)	21.5° to 29°
330 (13.0) and above	22° to 30°

1600 OHC (LC) Colour Code Yellow/Orange 76HF 12100 EA
January to March '78

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
400 and below	0
500	−1° to +1°
950	−1° to +1°
1000	−1° to +1.5°
1050	−1° to 2.5°
1500	7° to 11°
2000	16° to 20°
2200	20° to 24°
3000	24° to 28°
4000	29.5° to 33.5°
4600 and above	32.5° to 36.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
50.8 (2.0) and below	0
63.5 (2.5)	−1° to +1°
114.3 (4.5)	−1° to +2°
127.0 (5.0)	−1° to +3.5°
152.4 (6.0)	2.5° to 6.5°
177.8 (7.0) and above	6° to 10°

TECHNICAL DATA (cont'd)

Detailed Advance Characteristics (cont'd)

1600 OHC (LC)
April '78 onwards

Colour Code Brown/Green

78HF 12100 NA

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
600 and below	−1.0° to +1.0°
960	−1.0° to +1.0°
1080	−1.0° to +3.0°
2000	13.0° to 17.0°
3000	21.5° to 25.5°
4600 and above	32.5° to 36.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
50 (1.97) and below	0
60 (2.4)	−1.0° to +1.0°
125 (4.8)	−1.0° to +3.0°
180 (7.1)	6.0° to 10.0°
205 (8.1) and above	9.0° to 13.0°

2000 OHC (Manual)
January to April '78

Colour Code Yellow/Green

78HF 12100 AA

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
400 and below	0
500	−1° to +1°
1000	−1° to +1°
1500	+1.5° to +5.5°
2000	7.5° to 11.5°
2500	13.5° to 17.5°
3000	19.75° to 23.5°
3500	24.0° to 28°
4000	27.0° to 31°
4500	30.5° to 34.5°
4800 and above	32.5° to 36.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
70 (2.76) and below	0
80 (3.15)	−1° to +0.75°
90 (3.55)	−1° to +1.25°
100 (3.94)	−1° to +2°
110 (4.33)	−1° to +5°
120 (4.73)	+1° to +8°
130 (5.12)	5° to 10.75°
140 (5.52)	7° to 13°
150 (5.91)	9.5° to 15.25°
160 (6.30)	11.25° to 17.5°
170 (6.70) and above	13° to 19.0°

2000 OHC (Manual)
April '78 onwards

Colour Code Brown/Blue

78HF 12100 RA

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
1200 and below	−1.0° to +1.0°
1400	−1.0° to +3.0°
2000	5.0° to 9.0°
3000	14.5° to 19.5°
4000	24.5° to 30.0°
4800 and above	32.5° to 36.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
70 (2.8) and below	0
75 (3.0)	−1.0° to +0.5°
100 (3.9)	−1.0° to +2.0°
110 (4.3)	−1.0° to +5.0°
150 (5.9)	9.4° to 15.4°
190 (7.5) and above	16.0° to 22.0°

TECHNICAL DATA (cont'd)

Detailed Advance Characteristics (cont'd)

2000 OHC (Automatic) Colour Code Brown/Red 78HF 12100 BA
January to April '78

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
400 and below	0
500	−1° to +1°
1000	−1° to +1°
1500	+1.5° to +5.5°
2000	7.5° to 11.5°
2500	13.5° to 17.5°
3000	19.75° to 23.5°
3500	24.0° to 28°
4000	27.0° to 31°
4500	30.5° to 34.5°
4800 and above	32.5° to 36.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
70 (2.76) and below	0
80 (3.15)	−1° to +0.75°
90 (3.55)	−1° to +1.5°
100 (3.94)	−1° to +2°
110 (4.33)	−1° to +5.5°
120 (4.73)	+2° to +9°
130 (5.12)	4.5° to 11°
140 (5.52)	7° to 13.25°
150 (5.91) and above	9° to 15°

2000 OHC (Automatic) Colour Code Brown/Orange 78HF 12100 SA
April '78 onwards

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
1200 and below	−1.0° to +1.0°
1400	−1.0° to +3.0°
2000	5.0° to 9.0°
3000	14.5° to 19.5°
4000	24.5° to 30.0°
4800 and above	32.5° to 36.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
70 (2.8) and below	0
75 (3.0)	−1.0° to +0.5°
100 (3.9)	−1.0° to +2.0°
110 (4.3)	−1.0° to +5.0°
150 (5.9)	9.4° to 15.4°
160 (6.3) and above	11.0° to 17.0°

2000 OHC (Economy) Colour code Yellow/Grey 78HF 12100 EA

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
400 and below	0
500	−1° to +1°
1000	−1° to +1°
1500	+2° to +6°
2000	7° to 11°
2500	12° to 17°
3000	17.5° to 22.5°
3500	23° to 28°
4000	28° to 34°
4500	33° to 39.5
4700 and above	35.5° to 39.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
130 (5.12) and below	
140 (5.52)	−1° to +0.75°
150 (5.91)	−1° to +1.5°
160 (6.30)	−1° to +2.0°
170 (6.69)	−1° to +5°
180 (7.09)	+2° to +8°
190 (7.48)	4.5° to 10.5°
200 (7.87)	7° to 13°
210 (8.27)	9° to 15°
220 (8.66)	11° to 17°
230 (9.06) and above	13° to 19°

TECHNICAL DATA (cont'd)

Detailed Advance Characteristics (cont'd)

2000 OHC (Nigeria Only) Colour Code Yellow/Black 78HF 12100 FA

Mechanical	
Engine rpm	Degrees Advance (Crankshaft)
500 and below	0
1000	−1° to +1°
1500	0° to +4°
2000	5° to 9°
2500	10° to 14.5°
3000	15° to 20°
3500	20° to 25°
4000	25° to 30°
4500	29.5° to 35°
5000	34.5° to 40.5°
5200 and above	36.5° to 40.5°

Vacuum	
Vacuum mm Hg (in Hg)	Degrees Advance (Crankshaft)
50 (1.97) and below	0
100 (3.94)	−1° to +2°
150 (5.91)	+7° to +15°
200 (7.87)	15.5° to 23°
250 (9.84)	19.5° to 27.5°
252 (9.92) and above	20° to 28°